

Annexes

**Impact Assessment of the AG/NRM
Strategic Objective of USAID/Senegal
(Old SO2)**

Volume 2 of 3

May 1999

EPIQ

Annex A.

**The Ecological and Historical Context
in Senegal**

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May 1999

For
USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

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1.0 Ecological Context¹

Senegal is a semi-arid country with a population estimated at 9 million (1998). It lies along the western-most portion of West Africa's Atlantic Coast, sharing borders with Mauritania, Mali, Guinea, Guinea-Bissau, and the Gambia. It has a surface area of 196,720 square kms, or 76,720 square miles, which is about the size of North Dakota. Its dimensions are approximately 700 km east/west and 500 kms north/south.

1.1 Land Resources

Senegal is a flat country, 90% of which is less than 100 m in elevation. Two-thirds of its territory occupies an ancient sedimentary basin which rarely rises more than 50 meters above sea level. The extreme south-east (Kedougou), covers a portion of the African Shield, and rises to a maximum of 400-500 meters. Approximately one fifth (19%) of the surface area is considered suitable for agricultural uses, one third (32%) is classified as suitable for forest or savanna, and the remaining one-half (48%) is classified as unsuitable for agricultural purposes.² These land resources are categorized in 13 eco-geographical zones in the NEAP as presented in the EROS/CSE eco-geographical zone map below.

Without going into great detail, it is important to note that soils throughout Senegal are classified as having average to below average agricultural potential. Because of its flatness, water erosion is an important factor in a relatively small portion of the country. However, many of the predominantly sand soils are very susceptible to wind erosion. The practice in the peanut basin of eliminating almost all tree cover from fields and leaving the soil completely bare following the peanut harvest has contributed to enormous soil losses through wind erosion.

1.2 Natural Vegetation

When considered in detail, natural vegetation across Senegal is quite diverse and complex, as indicated in the vegetation map below. Natural vegetation in Senegal is categorized as belonging to three large

¹ This section relies heavily on maps and graphics prepared by USGS/EROS/CSE and on preliminary drafts of text prepared for the EROS final report: "The State of the Natural Resources of Senegal: A Study of Long-Term Change", 1999, USGS EROS Data Center. The authors are: Gray Tappan, Amadou Hadj, Eric Wood, Ron Lietzow, Moussa Sall, Djibril Ndiaye, and Magatte Ba.

² CONSERE, 1995, cited in Bucknall et al.

ecological regions, which in turn is closely dependent on rainfall and evapotranspiration; the Sahelian, Sudan, and Guinean regions. The Sahelian region is

Eco-geographical zones

Eco-geographical zones

Vegetation map

Vegetation Map

Forest Status

Forest Status

approximately that arid area north of a line from Mbour to Bakel. Its vegetation is characterized by grasslands, including such species as *Aristida* and *Cenchrus*, dotted with acacia trees.

The Sudan region covers nearly 2/3 of the country, grassland gives way to a open woodland savanna, with tree species particularly present in the valleys. The characteristic species include *Cassia sieberiana*, *Daniella oliveri*, *Oxytenanthera abyssinica*, *Khaya senegalensis*, *Terminalia macroptera*, *Bombax costatum*, and *Sterculia setigera*. The Guinean region is restricted to the extreme south-west corner of Senegal where again forestation is particularly dense in the valleys. The dominant woody species include: *Parkia biglobosa*, *Ceiba pentandra*, *Khaya senegalensis*, *Detarium senegalensis*, *Parinari excelsa*, *Daniella oliveri*, and *Cola cordifolia*. In some places there are important populations of *Elaeis guineensis* and *Borrassus aethiopium*. As a result of declining rainfall over the last 20-30 years, the area dominated by arid Sahel species has expanded in the northern part of the country, and Sudan and Guinean species have retracted further south. This change is observed primarily in terms of reduced species richness and in some areas as substantial mortality of species whose needs with regard to rainfall are no longer met.

Patrick Gonzales, in his dissertation on the subject estimates that the Sahelian and Guinean ecological zones have shifted southward about 25-30 km between 1945 and 1993.³

1.3 Forests

Wood and charcoal are the primary energy sources in Senegal covering 94 percent of domestic energy and 54 percent of total energy consumption. Consumption is estimated at 3.5 million m³ annually while potential fuelwood production is estimated at 3.1 million m³ per year. While the deficit is relatively small at present, increasing population and decreasing forest reserves may result in a deficit of over 4 million m³ per year by 2010.

The NEAP estimates that while various types of forest still cover more than half of Senegal, forest area declined from 12.7 million ha in 1980 to 11.9 million ha in 1990. Senegal has 213 protected forest areas covering about 6,238,000 ha among the total 6.5 million ha which are part of protected areas. The EROS/CSE estimates that 200,000 ha have been cleared each year would seem to indicate that the change may be even greater, although certainly not all of the land cleared for agriculture each year is classified as forest land. The state of these protected forests varies but many are significantly degraded due to drought and encroachment for agricultural purposes. As examples, EROS analysis indicates that in Kolda, agriculturalists have converted only 4.6 % of the Guimara Forest, but 28.8% of the Pata Forest.⁴ The

³ Gonzalez, Patrick, 1997, Dynamics of biodiversity and human carrying capacity in the Senegal Sahel.

⁴ Gray Tappan, personal communication.

forest status map above indicates how forest areas have become degraded between 1965 and 1994. The degradation of forest resources and natural vegetation in general is a function of drought conditions, the over exploitation of forest resources for fuelwood and charcoal and the clearing of forest land for agricultural purposes.

1.4 Land Use

USAID/Senegal's 1991 Agricultural Sector Analysis estimated that 62 percent, or 2.356 million ha of the approximately 3.8 million ha of arable in Senegal were cultivated. It added that when fallow land was included, this increased to 79 percent or 3 million ha. It estimates that per-capital land under cultivation declined from 0.5 ha per person to less than 0.3 ha per person between 1976 and 1990.⁵ The 1997 Senegal Agricultural Sector Analysis Update estimates that 65 percent of the Senegal's potentially arable land is cultivated, based on data reported by CONSERE in a 1995 report. EROS/CSE use estimates based on measurements of land cleared for agricultural purposes taken from the mapping of land use from satellite imagery and aerial photography. They estimate that in 1965, 20.36 percent of Senegal's land area or approximately 3.994 million ha was cleared for agriculture and that this increased to 25.51 percent, or just over 5 million ha in 1990. They also found that within these areas devoted to agricultural use, fallow declined from about 50 percent in 1965 to about 30 percent in 1990.

The figures from EROS/CSE indicate that more land has been cleared and used for cultivation than previously believed. Their estimate of about 3.5 million ha actually cultivated in 1990 (70 % of 5 million ha) is reasonably close to other estimates. But EROS/CSE data indicate that already in 1990 the total amount of land cleared and used for agricultural purposes (although not necessarily cultivated in that particular year) significantly exceeds the earlier estimates of total arable land in Senegal.

EROS/CSE estimate that between 1965 and 1990, the amount of land cleared for agricultural purposes increased by about 1 percent or 200,000 ha per year. They have used this data to do some computer modeling which projects future impacts with some rather startling results. By 2030, all arable land in Senegal outside of the protected areas will be under cultivation. By 2050, every scrap of arable land in Senegal will be cultivated, including any found in the protected areas and other forest zones. In these estimates, EROS/CSE obviously use a more liberal definition of arable land than used in previous studies, since the 3.8 million ha of arable land generally used from previous studies was already surpassed in 1965.

⁵ The estimates are based on FAO data from 1976.

Fallow map

Fallow map

Fallow trends

Fallow trends

Agricultural expansion maps

Agricultural expansion maps

EROS does not mean to imply that this has to be the future. Rather this will be the future unless steps are taken to ensure the provision of basic agricultural services which in turn provide the enabling conditions for a productive and profitable agriculture. Only then will farmers be able to take the steps towards agricultural intensification that will allow Senegal to avoid this fate. And only when they need to protect or enhance streams of income from profitable agricultural, livestock and forestry are farmers likely to adopt the NRM practices that will maintain the NRM resources on which those activities are based.

1.5 Rainfall

Rainfall in Senegal varies from less than 200 mm in the north to over 1000 mm in the south. However, both the total quantity and its distribution throughout the rainy season are highly variable. Historic rainfall data indicates some steep declines in rainfall particularly in 1910-20s and again in the 1940s. However the declines since 1968 are the largest recorded for total rainfall, the length of the rainy/growing season, and the number of days on which rain fell. While there was a temporary increase in the late 80s and early 90s, it produced only a minimal impact on the medium-term (7 year) rainfall averages (see diagram X, below).⁶

It is often estimated that 400 mm of rainfall is the minimum amount necessary for the production of rainfed crops. Some sources go a step further and indicate that 500 mm is a more appropriate level on the basis that this provides an 80% probability that 400 mm of “usable” rainfall would be received.⁷ The EROS historical rainfall maps above, indicate that during the serious drought years of the 1940s, approximately 85% of the country received more than 400 mm of rainfall. During the 1970s and 1980s, perhaps only about two thirds of the country received the necessary 400 mm, and by the early 1990s, perhaps only 60% of the country received that amount. Equally important, the declining rainfall in the southern half of the country makes many farmers wonder whether the probability of having good rainfall is sufficient to be worth an investment in soil fertility enhancements such as fertilizer. A useful rule of thumb often used in the Sahel is that 80% of the variation in agricultural production from year to year is due to changes in rainfall. Given the significant decline in rainfall from the 1950-60 period to the period between 1970 and 1995 it is little wonder that it has been difficult to increase agricultural production in Senegal. Rather, it is surprising that Senegal has not experienced a 20-30% decline in agricultural production on the basis of declining rainfall alone.

⁶ EROS/CSE, Trends in Average Cumulative Rainfall.

⁷ USAID, 1991, Senegal Agricultural Sector Analysis.

Historic Rainfall Maps

Historic rainfall maps

Trends in Average Cumulative Rainfall

Trends in Average Cumulative Rainfall

2.0 Historical Context

2.1 Population

Senegal's population is estimated at 8.8 million in 1997, and to have reached 9 million in 1998.⁸ With women bearing, on average 5.7 children each, the population continues to grow at a rapid pace, although recent estimates indicate that the rate of growth has fallen from 2.9% to 2.7%. In 1900, the population of Senegal was estimated to be about 1 million persons. By the year 2000, the population (9.5 million) will have increased just short of 10 fold during the century. Based on the above estimates, the population will exceed 12 million by 2010 and double to over 18 million by 2025. Three fifths of the population is under the age of 20 (59%) and over one third are under the age of 10.⁹

About 60% of the population lives in rural areas. Nearly two-thirds of the population is concentrated in the 18 percent of the national territory covered by the Peanut Basin (Thies, Diourbel, Fatick and Kaolack) and Dakar. Calculations indicate that the rural population densities in the Peanut Basin range from 31 (in Kaolack) to 169 persons/km² in Thies. Most of the eastern part of the country has rural population densities ranging from 7 to 17 persons/km², with the exception of Kolda at 33 persons/km². Furthermore, if one uses the population per square km of arable land, eastern Senegal no longer looks so under populated. While Kolda and Tambacounda have among the lower population densities when compared to total land area, their population densities relative to arable land exceed that of Kaolack and approaches that of Diourbel.

⁸ All population estimates are extrapolations from the 1988 census, based on the population growth rate.

⁹ USAID, 1998, Country Strategic Plan and MCH/PF data.

Graph of population increase 1900-1995

Dakar: urban growth

Figure 12: Rural Population Densities by Region

Region	Surface Area (km2)	Arable land (km2)	1998 pop. estimate	1998 rural pop. est.	1998 rural pop. density for total area (pop/km2)	1998 rural pop. density for arable land (pop/km2)
Dakar	550	80	2,164,806	86,592	157	1,082
Thies	6,600	3,700	1,242,330	1,114,403	169	301
Diourbel	4,359	3,500	848,860	402,360	92	115
Kaolack	16,010	7,688*	1,047,877	496,694	31	65
Fatick	7,935	3,810*	608,705	549,330	69	144
Louga	29,188	5,000	545,892	414,606	14	83
St.. Louis	44,127	2,540	810,404	729,090	17	287
Ziguinchor	7,339	1,941^	517,141	368,757	50	190
Kolda	21,010	5,567^	759,708	694,530	33	125
Tambacounda	59,602	4,000	493,999	435,383	7	109
Senegal	196,720	37,817	9,039,722	5,291,745	27	140
Senegal w/out Dakar	196,170	37,737	6,874,916	5,205,153	26	138

Source: USAID: MCH/PF, current data for pop. estimates
Bucknall et al, 1997 for surface area

- % The original data is for the Sine-Saloum. Extrapolation to each region is based on the heroic assumption that both regions have an equal percentage of arable land, which is the same as the original percentage of arable land in the Sine-Saloum.
- % The original data is for the Casamance. Extrapolation to each region is based on the heroic assumption that both regions have an equal percentage of arable land, which is the same as the original percentage of arable land in the Casamance.

These calculations have several important implications:

- The land with relatively good agricultural potential in the frontier zone of Eastern Senegal is already largely under cultivation.
- Population pressure will rapidly begin to cause serious degradation of the natural resource base in Eastern Senegal, as immigrants clear and cultivate increasingly marginal lands.

- The frontier zone of Eastern Senegal may not provide the escape valve for excess population on which decision makers seem to be counting.

2.2 Colonial AG/NRM Policy

Colonial policy with regard to natural resource management was primarily focused on the establishment of protected pastoral and forest areas. Most of the protected areas in Senegal were established between 1930 and 1955. Reforestation was primarily oriented towards enriching protected forest areas, tree plantings in the towns and villages, and dune stabilization along the coast between Dakar and St. Louis. The Forest Service was established and oriented towards policing the use of forest products, and policing access to the protected forests in particular. The population was excluded from any involvement in forestry interventions.

During the colonial era there was little orientation towards soil protection and regeneration of natural ecologies. The peanut basin, which was center of the colonial economic activities and attention, is relatively flat which limited the water erosion problems. The limited population, presence of natural vegetation, and dependence on manual cultivation limited the threat of soil erosion and land degradation. Except for a period during the 1940s, rainfall was generally favorable.

2.3 Post-Independence AG/NRM Policy

During the period 1960 to 1980, NRM policy was an adjunct to general agricultural policy, particularly since a Ministry of Rural Development presided over the whole domain. Like the colonial government, the new independent government of Senegal had a statist orientation. Parastatal organizations providing: fertilizer, input delivery, marketing, research, agricultural equipment, financial and extension services, etc. were either perpetuated from the colonial era under a new name, or created. State run cooperatives were the organizing concept at the village level. Rural populations had little input into any decision making regarding the choice of interventions; civil servants made most decisions for the villagers.

There was a strong orientation towards the integration of livestock production and cropping, in order to support the use of animal traction. The integrated system was intended to intensify crop production and improve soil fertility through the application of manure and plowing down stalks, stubble and other organic matter at the end of the rainy season. However, the vision of intensification depended on the use of oxen. Penned oxen allowed the collection of significant quantities of manure, and only oxen were strong enough to turn enough soil, to actually plow down organic matter at the end of the rainy season. But the end of season plowing needed to be done while the ground was still damp, and most crops were not harvested until after the ground was completely dried out. Recommended practices which would have helped maintain soil fertility such as end of season plowing and more intensive manure production and application were not technically, socially and economically acceptable to rural producers.

Researchers and the extensions services worked hard to introduce agricultural intensification through the use of a complex oxen traction package, including plowing, planting in rows, use of improved seeds, application of manure and fertilizer, thinning, and weeding, use of crop rotation and fallow, etc. But most farmers rejected the very expensive oxen traction, and instead adopted the use of horse or donkey traction to pull seeders. Farmers knew, and researchers later learned, that there is a severe penalty for not planting immediately after the first “usable” rains (typically 20 mm or more). Researchers were able to calculate that there was a considerable decrease in “expected” yield and production for each week’s delay following the first “usable” rains. It was this factor that pushed farmers to plant their entire crop as quickly as possible. Particularly in light sandy soils, they rejected the recommended plowing and planted directly as quickly as possible. Since the animal drawn planters allowed them to plant more land area in a timely manner than was possible with manual practices, it resulted in an extensive agricultural practice, rather than in intensive one. Other components of the animal traction package, if adopted, were typically adopted piecemeal, over an extended period of time. Rural populations had great difficulty paying their crop and equipment debts, due to recurring droughts and smaller production increases than predicted on the basis of the technical packages’ potential results.¹⁰

One of the recommendations linked to the animal traction package that was adopted and did have long-term environmental implications, was the practice of clearing cultivated land of all trees and roots, to make plowing, planting in rows and other animal traction related activities easier and more efficient. Farmers eliminated all but a very few of the most useful trees from their fields, resulting in the denuded vistas that one now finds throughout much of the peanut basin and its extensions.

The denuded soils allowed extensive wind erosion, and the beginning of water erosion wherever there was physical relief. The dependence on chemical fertilizer and the limited use of organic matter, meant that the soils dried out more quickly and crops were more susceptible to drought conditions when rainfall declined. Population pressure brought about a continual decrease in the length of fallow, to the point where it was eliminated almost completely. The gradual degradation of the land resources had begun, but did not reach a crisis stage until exacerbated by the affects of drought and reduced access to fertilizer.

In 1973, the Ministry of Protection of Nature was established and delegated responsibility for policy and activities specifically focused on forests, parks, and environmental issues and natural resource management in general. This does not change the fact that farmers/rural producers who integrate crop, livestock and forestry activities by necessity, are still the actors with the greatest impact on natural resource management in Senegal.

¹⁰ Based on the findings of Sargent, Lichte, et al, 1980.

2.4 Structural Adjustment ¹¹

At independence, Senegal had a highly educated elite, a functional physical infrastructure, a solid productive base, a surplus of civil servants and oversized industries created to serve a regional colonial market. In 1960, Senegal's per capita GDP was higher than most countries in Africa and even East Asia (e.g., South Korea). In the first two decades following Independence (1960-1980), Senegal experienced the least economic growth of any African state not affected by war or civil strife. Average real GDP grew only by 2.1 percent per year, while population growth was growing at 2.8 percent, resulting in a decline in per capita income.

During the 1960s and 1970s, Senegal adopted policies characterized by strong government intervention in factor and product markets, lack of fiscal discipline, and trade and industrial protectionism. These policies resulted in low levels of saving and investment, which combined with high population growth rates, led to stagnation of GDP per capita. But the substantial volume of foreign aid which Senegal was able to attract because of its strategic position and political stability, removed the external financing constraint. The combination of inadequate policy management, low growth and adverse conditions in the external environment finally led to a major economic crisis in the late 1970s. By 1981, all key economic indicators reflected serious financial and structural imbalances: the fiscal deficit stood at 12.5 percent of GDP, the current account deficit reached 25.7 percent of GDP, the inflation rate soared to 12 percent per annum, savings were negative, and total consumption exceeded GDP. The total stock of debt represented over two-thirds of GDP and the debt service represented nearly one-fifth of total exports.

Adjustment efforts, initiated in the 1980s, were partially successful in restoring macroeconomic balances, but not in reducing the structural rigidities of the economy, in particular the weight of the public sector. Progress was made on reforms concerning the parapublic sector and production incentives under SAL I. Progress was made on reforms concerning industrial incentives, liberalization of most prices, elimination of quantitative restrictions and most non-tariff barriers, liberalization of the agriculture sector, public enterprise reform and improved public resource management under SAL II and SAL III. Progress was made on reforms concerning civil service reform, the parapublic sector, industrial incentives, elimination of direct subsidies to public enterprises and on privatization, on simplifying the tax structure, and on reducing the size of the civil service under SAL IV. The reduction in the civil service was not sustained however, and other conditionalities including adoption of a revised Labor Code and privatization of SONOCOS, the groundnut parastatal were not met.

¹¹ This section draws heavily on three sources, particularly the first:
World Bank, 1997, Senegal: the Challenge of International Integration.
World Bank, 1993, Senegal Stabilization, Partial Adjustment and Stagnation, quoted in Bucknall, et al., 1997.
World Bank, 1995, Country Assistance Strategy for the Republic of Senegal.

Economic conditions worsened in the early 1990s because of a substantial decrease in the terms of trade (4 percent a year during 1991-93), recession in Europe and repeated droughts. While constrained by a fixed exchange rate within the CFA zone, the authorities attempted to raise competitiveness through higher tariffs and export subsidies, and demand compression policies. But the task was made difficult by the low and falling inflation in France and the depreciation of currencies of the main trading partners. Thus the trade based exchange rate (trade weighted nominal effective exchange rate), which had remained stable between 1980 and 1985, appreciated by 47 percent during 1986-93. While restraints on domestic demand succeeded in lowering the inflation rate more than trading partners, the CPI-based exchange rate (real effective exchange rate (REER) declined by 13 percent but rose by 7 percent with respect to developing countries.

During 1991-93 current account revenues in dollar terms dropped by some 6.5 percent a year, reflecting declines in virtually all sources of foreign earnings, particularly in groundnuts, phosphates and private services. On a per-capita basis, revenues declined by 9 percent (and purchasing power declined by 7 percent per year), clearly unsustainable from an external financing perspective. The external balance worsened and investment and output stagnated. On average, GDP per capita fell by 2.8 percent per year during 1991-93.

Most CFA countries experienced a deep economic recession during 1991-93. Governments struggled to adjust their economies to declining terms of trade and weaknesses in major export markets within the context of a fixed exchange system. As the economic and financial crisis worsened, a devaluation could not be delayed. The decision was taken in January 1994, and Senegal, together with the other CFA countries, undertook a devaluation of the CFA franc (50 percent of the nominal, 35 percent of the real, exchange rate). The measure was accompanied by a stabilization program, centered on fiscal adjustment, and a program of structural reforms to increase market flexibility and develop the private sector, liberalize the economy and reduce the size of the public sector. Since 1994 the major reforms achieved include:

- Strengthening of domestic competition:
 - Liberalization of prices and abolition or re-negotiation of special agreements protecting several private and public enterprises;
- Liberalization of trade:
 - Elimination of prior authorization to import or export, and of customs reference prices; reduction in customs duties and simplification of duty structure; liquidation of import monopoly for all products but oil;
- Promotion of private investment and exports:
 - Revision of the overall investment regime and export processing zones and points francs;
- Reduction of transport costs:
 - Liberalization of maritime transport (elimination of the monopoly of the shipping enterprise);
- Increase in labor market flexibility:
 - Elimination of prior authorization necessary for layoffs for economic reasons;

- Reduction of the role of the State in the economy:
Privatization of specific functions of the water company, of rice mills and the stabilization board; opening up in the capital of the telecommunications company and of smaller companies; preparation of a plan to privatize most of the remaining public enterprises; preparation of an audit of the civil service and settlement of cross debts within the public enterprises.

2.4.1 Macroeconomic Effects of Structural Adjustment ¹²

Figure 13: Macro-Economic Indicators

	1986- 1990	1991- 1993	1994	1995	1996	1997 est.
GDP growth	3.3	0.0	2.0	4.8	5.6	4.7
GDP per capita growth	0.3	-2.8	-0.6	2.2	3.0	2.1
Gross domestic investment/GDP	12.6	13.1	13.7	15.6	16.3	16.7
Private investment/GDP	8.6	8.9	9.0	10.8	11.5	11.7
Gross domestic savings/GDP	6.5	5.6	7.4	10.4	11.4	11.8
Growth in exports, GNFS	7.9	-3.7	5.3	9.4	4.8	0.7
Inflation rate (CPI)	0.1	-0.8	32.1	8.1	2.8	2.5
Real Effective Exchange Rate (REER)	0.4	-2.0	-35.1	8.3	0.6	-2.9
Current account deficit/GDP (a)	-10.7	-9.5	9.3	-7.9	-7.2	-6.1
Fiscal deficit/GDP (a)	-3.1	-1.9	-5.7	-3.2	-2.0	-1.3
Terms of trade (\$)	-3.7	-4.4	4.1	-2.4	-1.7	6.4

(a) Excluding grants

Source: DECPG, World Bank, quoted in World Bank, 1997, Senegal: the Challenge of International Integration.

The limited analysis available on the period following the devaluation in 1994 would seem to indicate that the effects of the devaluation and of the program of structural adjustment reforms has been largely positive. The 35 percent devaluation of the real exchange rate in 1994 prompted a broad-based recovery of foreign exchange earnings, in particular a significant rebound in key merchandise exports as well as tourism and private services. Senegal had the good fortune that the devaluation took place during a period of buoyant

¹² Source: World Bank, 1997, Senegal: the Challenge of International Integration.

world trade, which contributed to demand for Senegal's exports, and good rainfall in 2 of the 3 years following the devaluation. Increased world trade probably contributed more to increased demand for Senegal's exports than did the depreciation.

Inflation declined to a nominal 3 percent in 1996, real GDP growth increased in the range of 5 percent in 1995 and 1996, and both fiscal and current account deficits were reduced significantly between 1994 and 1996. The devaluation and structural adjustment reforms contributed to a substantial increase private investment and the ratio of private investment to GDP. The share of capital goods among imports became comparable to other African countries by 1996, although it remains at a level much lower than fast growing economies.

2.5 The New Agricultural Policy

The New Agricultural Policy (NPA) of 1980-85 announced the impact of structural adjustment on AG/NRM policy. Structural adjustment resulted in the disengagement of the Government from the provision of basic agricultural services, including input delivery, marketing, financial services (credit) and extension services. The concept was to make producers more responsible for their own development and to cede many of the services previously provided by the government to the (commercial) private sector. The theory was that the commercial private sector would not attempt to provide such services as long as it had to compete with the government.

During this period, many of the parastatal organizations responsible for providing agricultural services were dissolved. Included among these organizations that were dissolved or saw their role greatly diminished were:

- The Office National de Commercialisation Agricole et de Développement (ONCAD), which marketed agricultural products, provided seeds, fertilizer and agricultural equipment (with a debt of 100 billion FCFA).
- The Banque Nationale de Développement Sénégalaise (BNDS), the major source of agricultural credit.
- The Regional Development Societies, SODEVA in the peanut basin and SOMIVAC in the Casamance, disappeared. Others such as SAED, in the Senegal River valley and SODEFITEX, the cotton company, saw their scope and mandate restricted to very narrow objectives. SONACOS and SONAGRAINES, the organizations in charge of credit, seed, fertilizer, processing and marketing of peanut products, are in the process of being privatized.

Extension services are no longer available except in those areas where SODEFITEX and SONACOS, to a limited degree, continue their operations. The World Bank proposed to progressively establish an integrated national extension program (Programme National de Vulgarisation Agricole [PNVA]) under a

15-20 year project similar to those it had implemented in several West African countries, but only implemented the pilot phase. The CERPs are present in all of the Arrondissements, but are largely inoperational since they lost their funding and mandate to do extension work, years ago, to the Regional Development Societies, now being dissolved or privatized.

Although most of the parastatal structures which provided the enabling conditions for encouraging agricultural production and productivity were dissolved or otherwise eliminated under the structural adjustment and New Agricultural Policy, food self-sufficiency remained the priority objective. The NPA contained no significant natural resource management activities, but also proposed the struggle against desertification as a priority objective.

2.6 Present AG/NRM Policy

Beginning in about 1996, and following the 1994 devaluation, agricultural policy has entered a new phase in which the focus is on reviving the agricultural sector, in the context of free markets and international integration. Stated policy gives priority to:

- Making credit available to producers so that they can obtain agricultural inputs; and
- The restoration of soil fertility through the use of rock phosphate.

As part of this policy of reviving the agricultural sector, the World Bank has four major agricultural initiatives in varying stages of preparation. These include:

- An agricultural services project that will support producers organizations;
- An agricultural sector investment program;
- A pilot project to promote agricultural exports; and
- A national program of rural infrastructure.

2.7 Other Policies that affect AG/NRM

A number of other policies have an important impact on the environment in which NRM activities operate. These include:

1. The land tenure or National Domain law 64-46 of June 17, 1964 and its related regulations. These texts establish the legal statute concerning land and land usufruct, the manner in which land can be claimed, and the claim maintained, and the manner in which land tenure conflicts would be settled.
 - The law claims all land for the State (with a few exceptions), thus providing usufruct rights to users, rather than outright ownership. It specifies that land must be improved to maintain

use rights, and that land not improved can be claimed by others. (For all practical purposes, this results in disinheriting herders.) Improvements on the land can be sold, but not the land itself.

2. The Forestry Code established by law 93-06 of February 4, 1993. It was updated by decree 95-357 of April 11, 1995 and again in January 1998.
 - The major implication for NRM is the change that allows a person who plants and maintain a tree to cut that tree, after asking permission from the Forestry Service.
 - There seems to be some change in attitude with regard to the case of Jig Jam in the CR of Fissel. Here local residents have been authorized to serve as auxiliary forest agents, with the right to warn and fine persons breaking the code, and even require them to appear before the *sous-prefet*.
3. The Reform of Territorial and Local Administration law 72-25 of April 19, 1972 establishes the Rural Community (*Communautes Rurales*, similar to a country) as the lowest level of public administration guided by elected public officials. However, decentralization was not a dynamic process until the Decentralization law 96-07 was completed on March 22, 1996. This new law transferred responsibility for 9 sectors to the Rural Community, including planning, property, land management, and environment and natural resource management. Until the new law of 1996 local administrations had little jurisdiction over land use or the preservation of natural resources.
 - This provided legal backing for the initiatives already taken under CBNRM.
4. The Environmental Code established by law 83-05 of January 28, 1983. This Code, presently under revision principally addresses issues of urban environment, pollution and public health.
5. The National Environmental Action Plan, accepted by a national seminar of stakeholders in September 1997 and adopted by an inter-ministerial council in January 1998. The NEAP constitutes the strategic plan for the identification of national environmental priorities and the definition of an effective system of natural resource management is defined.
6. The decree 80-268 of March 10, 1978 which related to the organization of animal pasturing, particularly when animals can be turned loose after harvest.
7. The Water Code established by law 81-13 of March 4, 1981, which establishes water as a common good resource.
8. The Hunting Code established by law 86-04 of January 24, 1986 and the regulations established under decree 84-844 of July 14, 1986 concerning hunting and wildlife protection.
9. The Mining Code established by law 88-06 of August 26, 1988 and completed by decree 89-07 adapted the mining legislation to the realities of mining exploration and exploitation. The mining

code addresses forest preservation and the rehabilitation of mining sites following their exploitation. Relatively small rehabilitation taxes are collected from mining companies, but are deposited in the National Treasury and are rarely available to rehabilitate the sites in question.

10. The Oil Code established by law 86-13 of April 14, 1986 related to non-renewable resources.
11. The Ocean Fishing Code established by law 87-27 of August 18, 1987.
12. The Urban Code established by law 88-05 of June 20, 1988. The Urban Code specifies the regulations concerning the ownership, transfer and use of urban space. However it says little about the expansion of urban areas on rural lands which fall under the National Domain and how urban expansion affects such resources.
13. The Hygiene Code established by law 83-71 of July 3, 1983.

2.8 USAID/Senegal AG/NRM Policy

During the life of the AG/NRM strategic objective, USAID/Senegal has also largely withdrawn from its traditional role in agricultural policy and support for agricultural research and production. This seems to be a USAID wide phenomenon, probably in part linked to the poor performance and rejection of Integrated Rural Development projects in the 1970s and 1980s. Since the late 1980s, as evident by looking at the programs funded under the AG/NRM SO, USAID Senegal has focused on programs with narrowly defined purposes and orientations, including:

SZWM:	construction of anti-salt dams and structures
KAED:	small enterprise development in rural communities
NRBAR:	agricultural research focused on NRM issues
CBNRM:	promoting community participation in decision making in the context of NRM activities

However, most of these narrowly focused programs maintained a broad goal level objective related to increasing rural production, productivity and/or income.

2.9 Results of AG/NRM Policy Changes

The most obvious result of the changes in AG/NRM policy since Senegal began to undertake structural adjustment in the early 1980s is that basic agricultural services, which provide the enabling conditions for a productive and profitable agriculture, are presently not provided by anyone. The Government has

dissolved or otherwise eliminated the roles of the parastatal structures which were created to provide such services after independence. Most of the markets have been liberalized and the monopolies and State control eliminated. But the commercial private sector which was expected to take up the role of providing such services, did not respond. Almost 15 years after the Government began to disengage from providing such services, the commercial private sector still has not made significant progress in filling the void, with the exception of traditional commodity marketing networks. For nearly two decades, most farmers have had very limited access to credit, improved seeds, fertilizer, and extension services, yet people wonder why the production and productivity increases in the agricultural sector have stagnated. It is as if in targeting one set of enabling conditions under structural adjustment and market liberalization, everyone has lost sight of the farmers need for basic agricultural services (however they might be provided).

Until basic agricultural services(e.g., credit, agricultural inputs, marketing, and extension services) are again available to the majority of farmers (male and female) targeted by the narrowly focused AG/NRM programs; those farmers and the narrowly focused AG/NRM programs have little chance of increasing agricultural productivity, or of having a significant impact on rural incomes. One must ask if there can be economic growth in rural Senegal in particular, and Senegal in general, until basic agricultural services are available to rural producers and the agricultural research and extension system functions in a reasonably adequate manner. Further, one must ask how much one can expect farmers to invest in long-term improvements of their productive resources if that production is not profitable, or is only marginally profitable, in the short- and medium-term.

Findings:

1. Most farmers do not have access to basic agricultural services such as credit, agricultural inputs (improved seed, fertilizer, equipment), and extension services.
2. Over the 15-20 years since the Government began its policy of disengagement, the commercial private sector has not stepped in to fill the void.
3. Narrowly defined SO2 programs have had little chance to attain their goal level objectives of increased agricultural productivity and increased rural income. Basic agricultural services which are among the enabling conditions for a productive and profitable agriculture, have not existed during the period in which the SO was in effect.

There seem to be several import lessons to learn from this experience:

1. Narrowly defined programs are not sufficient to increase agricultural production and rural incomes unless those programs work in an environment in which the basic enabling conditions for a productive and profitable agriculture already exist.
2. Disbanding parastatal organizations and market monopolies alone is not sufficient to entice the commercial private sector to take up the responsibility of providing basic agricultural services (or that 15 years is not a long-enough time period for that to take place).

2.10 Affects of the Historical and Ecological Context on Agricultural Production

The agricultural sector, including forestry, livestock and fishery, accounts for a modest share of approximately 20 percent of GDP and for 60 percent of employment. From 1978-1996, long-term growth of the agricultural sector averaged 2.0 percent. Agricultural sector production has increased only 7 of the 19 years in question, increasing 7.6 percent per year during 1985-1988 and 6.7 percent per year from 1994-1996, following the devaluation in 1994. Crop production recorded even larger swings, primarily as a function of good and bad rainfall years. However, given the population growth rate of 2.7 percent (and even higher in past years), average per capita agricultural production has fallen over the 19 year period.¹³

EROS estimates that the area under cultivation has expanded at approximately 1 percent per year (ignoring the decrease of land in fallow, which for their purposes is included in cultivated area). Given the rapid decline in fallow land, the total increase in land cultivated may have approached the 2 percent level similar to average long-term agricultural growth. However, since this is less than the rate of population growth, the area cultivated per capita has declined from about 0.5 ha to about 0.3 ha.

Other significant trends related to structural adjustment have been the decline in the use of chemical fertilizer and the aging of farm equipment. Officially, the purchase of fertilizer was subsidized through December 1988, but use fell from a high of about 85,000 ton in 1975-76 to less than 30,000 tons during the early 1980s and to less than 30,000 tons during the late 1980s. Fertilizer use rose some in the early 1990's but fell back into the low 30,000 ton range following the significant price increase caused by the 1994 devaluation. Fertilizer use fell even before the end of the subsidy, at least in part because of other aspects of the government's disengagement from providing basic rural services. Effective access to such services as the supply of inputs (improved seeds, fertilizer and agricultural equipment), credit to pay for the inputs, etc. was already on the decline.

In the absence of soil fertility amendments and measures to control soil erosion, traditional practices tend to exacerbate soil degradation. Particularly in the peanut basin, fields are cleared almost completely of any trees and other vegetation to allow easy use of animal drawn equipment. While a crust may form over the soil during the rainy season, this crust is broken to harvest the peanuts, leaving the soil loose and completely exposed. The combination leads to heavy soil loss by wind erosion during the harmattan season.

In addition to soil degradation caused by cultural practices, the expansion of cultivated areas and decline in fallow land has caused rural producers to place increasingly marginal land in production. With both the use of fallow and fertilizer declining, soil fertility and productivity in traditional farming areas has suffered.

¹³ Source: World Bank, 1997, Senegal: the Challenge of International Integration.

While some farmers still have access to improved seed, particularly shorter cycle varieties, many do not. Given the low productivity of land and high risk of insufficient rainfall, many families try to limit labor inputs so that some family members can attempt to find off-farm income to supplement the farm production and income. In part, this is made possible by the falling land area available and cultivated per rural family member. The impact assessment team was not able to find estimates of how much these various factors might have reduced agricultural production or how many fewer farmers have access to such factors of production than had access in the past.

What is clear is that in combination with significantly lower rainfall, the reduced use of these various factors of production would be expected to result in appreciably lower agricultural production. By some estimates, the decline in rainfall alone might have been expected to reduce agricultural production in Senegal by 20-30 percent since the 1950-60 period. Given the reduced use in these factors of production, the expected decline would have been even larger. Since production has increased slowly at the rate of about 2 percent per year, it seems apparent that farmers have had some success in adjusting their production systems to address the effects of lower rainfall and both limited access to improved inputs and limited use of labor. It seems likely that a few key technologies such as the use of shorter cycle varieties and natural soil fertility enhancements (manuring, compost, acacia albida field trees) have had a positive impact in avoiding the sharp drop in agricultural production that one would have predicted.

Annex B.

Technical Analysis of NRM Practices

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March 1999

For
USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

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1.0 INTRODUCTION

USAID/Senegal's recently finished Strategic Objective 2 aimed to increase crop productivity through improved natural resource management (NRM) in zones of reliable rainfall (defined as greater or equal to 400 mm annual rainfall). This annex provides a technical assessment of natural resource management techniques used as indicators for progress in meeting the SO2, including live fences, field trees, compost, manure, and improved seed. Also included in this annex are other NRM practices such as woodlots and (water) erosion control, which were advocated by projects operating under SO2, as well as tree seedling nurseries, and improved cookstoves, both of which significantly impact natural resource activities.

The analysis provided is based upon a modified Participatory Rural Appraisals (PRAs) conducted in November 1998 and January 1999. The PRAs focussed on reasons for adoption of the NRM techniques listed above as well as impediments to adoption and from this, lessons learned have been drawn from completed projects such as KAED. Where possible, linkages have also been made between these constraints and potential policy changes at project, USAID or national levels.

The team has been asked by USAID/Senegal to complete two distinct tasks:

- determine the impact of USAID/Senegal-financed NRM activities under SO2, and
- conduct a mid-term evaluation of the CBNRM project.

As such, the report is divided into the following components.

Through the results from the PRAs, Section Two reviews the impact of four projects on project beneficiaries' knowledge, attitudes, and practices concerning the nine NRM indicators mentioned above. Specifically, the KAED and CBNRM projects are reviewed in terms of each of these NRM indicators, and the NRBR component of Rodale and Winrock/OFPEP are also examined as appropriate.

Section Three discusses general recommendations for planning and implementing future NRM activities. These recommendations are drawn from the lessons learned from USAID/Senegal's SO2 NRM activities as well as other NRM projects in the Sahel.

Section Four looks specifically at the CBNRM project. This section evaluates the impact and technical soundness of the project's activities using the series of NRM activities listed above. Although the preceeding section (Section three) is more general, there are aspects which are also relevant to the CBNRM project, and should be analyzed by USAID and CBNRM staff in that light.

2.0 NRM Technique Indicators: Impacts of KAED, CBNRM, Rodale and Winrock Projects

The discussion below is based upon field visits to the four projects in question. The emphasis in the section is upon generalized findings and observations and not necessarily upon the projects in question. As such, this section does not reference each technique on a project by project basis and the presentation is not organized sequentially by project. However, where appropriate, the author refers to findings and observations that are specific to a project.

2.1 Live Fencing

Many live fences were observed in CBNRM zones, however most of them pre-date the project. Given the level of effort involved, live fences should be established only to protect high value areas because farmers do not feel the level of effort is justified for regular rainy season crops. CBNRM supports this approach; the live fences seen by the assessment team were, for example, to expand a dry-season vegetable garden fence.

The *Euphorbia* live fences showed a fairly good spacing, although they could use some additional reinforcement with spiny tree species. Live fences established using only thorny tree species also had fairly good spacing distribution, in some cases, although replanting will be necessary to fill in holes where seedlings died. Other live fences, however, had spacing between trees that was far too spread out to be effective as a barrier to animals. At the same time, these trees were too closely spaced to be part of a windbreak. Unfortunately, there seemed to be a fair amount of confusion on the part of the farmers as well; the words "live fence" and "windbreak" were often used interchangeably. If the farmer wanted to protect his field tree plantings from wind rather than animals, he has expended unnecessary money and energy to buy and plant trees every two meters, yet if the farmer wants to protect his tree plantation from animal intrusion, a two meter spacing between his live fence trees is completely insufficient. Continued technical guidance to ensure spacing norms for live fencing are used is necessary, although it should be noted that the confusion among villagers concerning the technical norms for live fences and windbreaks is not unique to the CBNRM project.

Some CBNRM project-sponsored live fences, consisting only of tree seedlings, experienced high mortality rates. If implemented in high traffic areas, for example a garden area with a seasonal pond nearby, farmers may need to establish an *Euphorbia* fence first, and then plant tree seedlings every 20 to 50 cm inside the *Euphorbia* for reinforcement. Otherwise, the seedlings will be vulnerable to trampling by animals seeking nearby water. The advantage to this approach is that *Euphorbia* is quickly established, although it is difficult

to avoid gaps between cuttings. Supplemental planting of thorny tree species can fill in those gaps in the long term, ensuring the best long-term protection for the perimeter.

Winrock experienced similar limitations using unreinforced *Euphorbia* live fencing; the *Euphorbia* cuttings were not well established when farmers planted improved cassava inside

the fence. As a result, livestock caused a significant amount of damage to the cassava, reducing the amount of cuttings the pilot farmers had available to give to others.

Through demonstration plots (usually women's collective fields), thousands of villagers in KAED villages have seen the potential of traditional live fencing (*Euphorbia*) reinforced with a variety of thorny species. Although farmers have traditionally used thorny species to reinforce their *Euphorbia* fences, a crucial difference is that farmers typically use dead thorny branches rather than planting those same species just inside the *Euphorbia* fence. While attributing this change in knowledge solely to Africare's intervention is unrealistic, the KAED project can certainly claim credit for diffusing this knowledge to more people, particularly women.

Specifically, one very positive impact of KAED's presence was that several types of multi-use local tree species were used in most sites for the interior live fence. Most of these species can be pruned back to a thorny mass of branches, thereby reinforcing the *Euphorbia* fencing, and, at the same time, provide secondary products useful for income generating activities and household use. For example, *Zizphus mauritiana* fruit is often sold at local markets, *Acacia nilotica* pods are coveted both for their tannin content and as a livestock feed, and *Acacia raddiana* wood is useful for charcoal and construction, the bark provides tannin, and the pods are used as livestock feed. By using locally obtainable species, the project also avoided the problem of seed availability, which is one of the main constraints cited by villagers for the use of *Acacia holoserica*.

Women and men's attitudes towards live fencing have been altered as a result of the KAED project, however, women are rarely in a position to implement this practice beyond their group fields due to tenure issues. Tree planting is traditionally viewed as a permanent marker or claim to land, and as women rarely own land individually (in either the traditional or legal sense of "own"), and they expressed concern that if they were to implement live fencing or other tree planting practices on land loaned to them, that there would be negative repercussions for them. Until social changes occur where it is widely considered acceptable for an individual woman to own land, tree planting among women will be constrained, which will certainly limit the rate of increase of this NRM practice.

One notable exception to this is occurring in Segre Gatta, where despite limited personal land holdings, the women's group is collectively working in individual men's fields (all spouses of the women's group members) to implement live fencing plantings. Each year the group establishes live fencing in additional independently owned fields. This type of example, while not prevalent enough to significantly impact tree

planting rates, is a positive beginning. Whether this creative way of resolving a lack of land holdings results in a significant increase in tree planting rates remains to be seen.

In many KAED villages, the use of live fences has been modified to essentially that of a field demarcation planting. The impact of demarcation plantings is evident in most KAED villages as they have been widely adopted by individual farmers. These plantings occur on the edge of farmers' fields just as live fence plantings do, however, the spacing is much too wide to

be an effective barrier to livestock. Spacing between trees vary, but are generally much farther apart than live fencing or even windbreak plantings.

One possible explanation for the popularity of demarcation plantings is the increased land-use pressure as village populations increase. In the past when pressure on land was less of an issue, it would have been easier for a farmer to overlook a neighbor's encroachment onto his field to ensure continued social harmony. Most farmers had plenty of land, including land in fallow, and so they could simply increase their crop plantings elsewhere. Under current conditions however, it is increasingly difficult to lose part of one's field as many farmers do not have sufficient land to meet their family's food needs, so the popularity of delimitation plantings may be to assert ownership and therefore avoid future tenure conflicts.

Another possible explanation for the increase in demarcation plantings is the increased rural exodus among young men. As these men return to take over the family fields after a long absence, they may have forgotten the exact limits of their fields. As a result, they are vulnerable to a neighbor's encroachment into the family fields, and so tree plantings along the field's edge helps reaffirm their claim to the land. It is not clear if the majority of delimitation plantings are done by older or younger landowners - discussion about older farmers trying to anticipate future problems for their sons who may be currently working in the city or overseas as they know their wives' word will not be accepted over that of a neighboring male farmer. Regardless of the specific reasons for adoption of demarcation plantings, there is a clear increase of this type of practice in KAED villages.

Finally, it may be that this modified practice is being done simply because the project placed value on live fences and villagers wanted to please project staff with minimal effort on the villagers part. The end result is a modified form of live fencing easier to do.

2.2 Field Trees

The discussion of field trees below is divided into three sub-sections. The first addresses the traditional project approach to active field tree planting in which farmers use tree nurseries to develop seedlings which are out-planting at the onset of the rainy season. The second section addresses the promotion of natural regeneration. The third section addresses the use of windbreaks in fields.

Field tree plantings, where trees are intercropped with agricultural crops, is currently one of the best known NRM practices in KAED villages and is more readily practiced than other tree planting NRM activities such as windbreaks and live fencing (Dakano 1997).

2.2.1 Active Field Tree Planting

Many villagers in the KAED zone mentioned the increasing difficulty in letting land lie fallow as they do not have enough land to meet all their needs. As this pressure continues to increase, soil fertility will continue to decrease, so measures which increase soil fertility without taking the land out of production will become increasingly attractive. Furthermore, diversifying revenue sources is a logical strategy for resource-poor farmers. By increasing the number of trees on his/her land, a farmer would also increase other potential income sources.

The CBNRM project promotes a nice diversity of tree species as field trees in their Field Tree Plantation technical form. This encourages farmers to consider a wide range of possibilities when augmenting the number and types of trees in their agricultural fields and underlines project support for planting native tree species. For example, kadd trees will produce pods that farmers can sell in the local market as well as improving soil fertility through nitrogen fixation. Farmers' need to address decreasing soil fertility as well as a desire to diversify risk should lead to increased importance of field tree plantings in the future.

The same CBNRM technical form also advocates a 10 m x 10 m spacing when outplanting most species of trees in conjunction with agricultural crops. However, for farmers using animal traction, 5 m x 20 m is a much easier outplanting formation, and will still easily meet the optimal mature density (For example, with *Acacia albida*, 60 - 70 trees are recommended at maturity).

Therefore, it is prudent to revise the CBNRM technical form for Field Tree Plantations to meet technical recommendations while also providing the easiest outplanting configuration for farmers using animal traction. Changing spacing from 10 m x 10 m to 5 m x 20 m allows the same biological benefits, but also accommodates farmers' needs.

One impact of KAED on field tree plantings appears to be the result of local language literacy courses provided for by the project. Part of the course discusses the new Forestry Code so people realize that they do have increasing control over trees they plant and care for. By empowering villagers with knowledge of their tree rights, literacy training could continue to have a positive impact on adoption rate of tree planting NRM activities in the future. Promotion of local language literacy courses is very effective way to increase tree planting activities and should be encouraged by all projects.

2.2.2 Promotion of Natural Regeneration

As many of the species used in field tree plantings occur naturally, protection of natural regeneration is another option to achieve higher tree density in agricultural fields but which is a technique that is under-emphasized by all projects visited by the assessment team. For example, some of the species the CBNRM

project recommends for field tree plantings are *Acacia albida*, *Acacia nilotica*, *A. raddiana*, *A. senegal*, *A. sieberiana*, *Balanites aaegyptiaca*, *Parkia biglobosa*, *Pterocarpus erinaceus*, and *Tamarindus indica*, all of which occur naturally in various parts of Senegal, and thus could easily fit into a protection of natural regeneration activity.

Protection of natural regeneration should replace field tree outplanting. It is more realistic to advocate protection of naturally occurring seedlings with farmers in zones where a desired species occurs naturally than to outplant trees. Natural regeneration survival rates are often significantly higher (as these trees have already survived beyond the high mortality of a tree's first year), and implementing this practice requires considerably less money and time than outplanting field trees. Furthermore, it is an easy technique to learn and requires few or no inputs not already owned by farmers. Unfortunately, perhaps due to its simplicity, protection of natural regeneration is still an under-utilized technique by most projects.

2.2.3 Windbreaks

Windbreaks observed in the CBNRM zones were in the early stages of adoption with variable spacings between plants. Many farmers were establishing windbreaks as they had money to buy seedlings, but few were advanced enough to be very effective. An interesting technical variation is that farmers appeared to want their entire field surrounded by windbreaks, whereas typically a windbreak is only perpendicular to the predominant wind. This variation could also be a further indication of the confusion surrounding what is a windbreak and what is a live fence.

There is a need to re-emphasize spacing norms for windbreaks, that is, five meters between trees and 3-5 meters between rows if a second row of shorter trees is included. Technically ideal windbreaks requiring four rows of trees are unlikely to be adopted due to land use pressures, and as such should not be over-emphasized.

Furthermore, the importance of establishing a windbreak perpendicular to the wind to avoid a tunnel effect should be stressed. Directions perpendicular to the wind should always have first priority, even if a farmer ultimately wants to surround his or her whole field.

2.3 Tree Seedling Nurseries

A noticeable increase in the knowledge of how to set up and maintain tree seedling nurseries was noted in all KAED villages. In most observed cases, women and a few men profited most from the project's training. A high rate of adoption, at least during the project's life, was also noted. A variety of species were grown, including both forestry species and the more profitable fruit tree seedlings. By encouraging fruit tree production as well, the project was able to satisfy the women groups universal interest in income-generating activities (IGA) which would hopefully result in tree seedling production in subsequent years.

However, despite the substantial sums of money several women's groups earned from their tree nursery production, it is not apparent how many of these nurseries will continue without the project's presence. It appears this is due to several reasons including:

- the depth of the water table in some of the sites results in women feeling too much time being spent watering the trees (eg Dinguène Keur Ali Dié). Wells should not exceed 15-20 meters depth if water is hand-drawn, and less than 15 meters is better.
- the project arranged for the sale of many seedlings (particularly forestry seedlings for which it can be difficult to find a market) to various projects (including KAED for other KAED sites) and schools, which created an artificial demand for seedlings. Without the KAED demand and the school forestation activities which coincided with the KAED project, the women will earn substantially less money
- the women were not responsible for obtaining plastic pots, pesticides, and seeds for some of the species. While this does mean the women cannot find appropriate sources on their own, it is another impediment to timely nursery establishment. Villagers interviewed in November and in January had not thought about where they were going to obtain plastic pots although they indicated they would continue the nursery despite the absence of project staff.
- all the KAED nurseries visited had overproduced seedlings at least during the '98 nursery season, and several appeared to have overproduced in 1997 as well which can discourage sustained production.

As a result, it seems likely that the sustained use of seedling nurseries will drop without the presence of the KAED project.

One possible way to avoid this would be to encourage the production of fruit trees, particularly grafted trees, in areas with a high water table. Fruit trees are generally easy to sell in local markets, providing a steady revenue source. Grafted trees provide a higher return since they will produce higher quality fruit as well as early or late bearing varieties which avoid over-saturated markets. However, grafting also requires more intensive nursery training, post-training monitoring, as well as a source of quality scion material easily accessible to the nurseryman. Nonetheless, it is worthwhile to promote nursery production of fruit trees, particularly grafted fruit trees, in zones with adequate water table levels. If sufficient training and post-training monitoring is conducted, fruit tree grafting should continue after a project has ended.

The CBNRM project has also experienced various problems with tree seedling nurseries and has the potential for future problems, at least in the first generation sites visited by the assessment team. The technical form provided by the CBNRM project lists many important aspects of tree seedling production which could be useful to a nurseryman familiar with the general timing requirements. However, the technical instruction does not include the important timing relationship between the nursery start-up date and the seedlings' outplanting date. The vague mention of seeding dates and propagation duration means a nurseryman obeying the guidelines might have plants ready for outplanting as early as June, but could just as easily not have mature seedlings until mid-September.

This lack of emphasis on nursery timing and its direct impact on plant survival rates is a fundamental flaw of the tree nursery technical form. Even if CBNRM resolves the on-going bureaucratic delays mentioned below, this oversight will continue to contribute to low tree survival rates. Continued late timing of nursery production will contribute to villager discouragement for tree planting activities.

The nursery technical form should be modified to explicitly discuss timing requirements for various tree species. In addition, regional nursery calendars based on targeted outplanting dates should be established; count backwards from when the first good rain falls (late May to early/mid-July depending on CBNRM zone) and then count backwards to arrive at date a particular species must already be sown in the nursery. Timing for all other nursery activities (seed scarification, watering/weeding pots prior to sowing, filling pots, establishing nursery beds, etc.), should also be included and counted back to arrive at start-up dates for individual nursery aspects.

Another factor which contributed to the late outplanting dates was the late date when the sub-project agreements were signed by all partners (the *promoteur*, NRM committee president, CBNRM Project Director, Rural Council president, and a representative from the Ministry of Environment). Bureaucratic delays will undermine the best technically run nursery, and subsequently, all tree-planting activities and farmer morale.

The project staff should make every effort resolve bureaucratic impediments to tree nurseries and other NRM activities prior to activity start-up in order to avoid wasting villagers' time, effort and investment. If an activity has already started (for example the nurseries are already growing), bureaucratic delays should be resolved as quickly as possible to minimize the negative impact on tree survival rates.

Several farmers involved in tree-planting *micro-réalisation* CBNRM activities indicated that they were interested in a different tree species than what they eventually planted. In some cases, they were discouraged from using a particular species by a member of the CERP team, and in other cases they found that the tree species they wanted were not available in the nursery. If a species is inappropriate for the outplanting site, farmers should be encouraged to plant a different, more appropriate species. For example, a farmer wanting to plant mango trees in a field with a deep water table and far from a water source should plant a lower water-demanding plant. While some farmers were redirected for technical reasons, other times it appeared farmers were encouraged to switch to a different species because the second species (generally *Eucalyptus*) was more readily available in the nursery.

Species outplanted should not be based on what the nurseryman has decided to grow, rather, it should be based on what the farmer wants and needs for his or her outplanting site. Implicit in allowing the farmer to choose the species, is the idea that appropriate technical suggestions or choices have already been presented to the farmer, so his wants are based on the technical realities. If this fundamental decision is taken away from the farmer, it seems likely that interest in tree-planting activities will significantly diminish.

Therefore, it would be worthwhile for CBNRM to add a "Selection of Species" sub-heading to its technical form. This sub-heading should stress importance of meeting with people who will purchase/take seedlings from the nursery to create list of species and quantities to grow this year. The nursery manager should base his or her nursery on what the customer wants, not the other way around. Overt efforts on the part of project staff with technical training providers and nursery growers may be necessary to reduce over-reliance on *Eucalyptus*.

The limited number of species grown in the nursery could be due to a number of reasons. However, if a diverse and plentiful seed source at the time the nursery is being established is the problem, the project may need to help retrain nursery persons and/or provide incentives for early seedling delivery for a year or so to ensure that the species actually wanted by the villagers are the ones actually being grown. While having Dakar staff ensure that seeds are available for a village nursery is not sustainable long-term, in the short-term it may be necessary to avoid villagers saying their preferences are being ignored. As a result, the project staff may want to determine if the lack of tree seeds is contributing to lack of seedling diversity in the nursery. If so, project staff should take a more active role in ensuring seeds are available in the short-term, while training others how to obtain seeds for future years.

2.4 Compost

All the KAED sites visited had been taught about constructing compost pits and were aware of the benefits of compost. The two main reasons cited for adopting this NRM practice were the increased harvest yield and soil improvement. Interestingly enough, of all the project-promoted natural resource management activities undertaken by villagers, the number one activity varied from site to site, but compost was listed almost universally as the second most important activity based on PRA results¹⁴. In a few exceptions, women gave this activity a lower prioritization than the men, but there is little doubt of the impact of the project on people's knowledge and attitudes.

In addition to increasing awareness about the benefits of compost, all the KAED villages visited had groups and individuals who now use compost pits, including individual women who used the compost on land they were lent. It is strong indication of the importance placed on this activity that individuals were willing to invest time and effort in compost-making despite not having secure land tenure. One reason for this could be that compost is a land improvement that can be applied after an individual knows when they will be farming that year. However, given the multi-year benefits of composting, women's adoption of this NRM activity would undoubtedly increase dramatically if more women owned land instead of being temporary loaned a parcel. This underlines the importance of encouraging policy and societal changes which enhance

¹⁴ During the Participatory Rural Appraisal (PRA) process used by the assessment team, men and women were divided into separate groups and asked to enumerate NRM techniques they use, the advantages or benefits of those techniques, and to prioritize the overall importance of each technique as they saw it. A similar process was followed with villagers who had *not* adopted various NRM techniques to identify major constraints to NRM adoption according to villagers.

women's ability to obtain formalized usufruct land rights through the *communauté rurale's* (C.R.) certification process.

The Rodale, Winrock and CBNRM projects have all promoted cement-lined compost pits to farmers. However, cash requirements for this style compost pit exceeds the average farmer's budget. As a result, cement compost pits are inaccessible to many farmers who are aware and convinced of the advantages of composting. Furthermore, in what appears to be an attempt to save money on cement costs, most cement-lined compost pits observed at CBNRM sites were already falling apart after only a year's use. Many of these pits will no longer have cement walls within a few years.

It seems a balance between the ideal technical solution and the socio-economic reality of rural Senegalese is needed in order to achieve widespread adoption. Cement-lined pits are out of reach financially for the majority of farmers; most of the farmers we visited with who had cement-lined compost pits had other jobs (Alphabetization instructor for another project, etc) and as such had a sufficient outside cash flow to allow them to use this technology.

Targeting only those people with outside means will not lead to widespread adoption of compost.

One way to increase adoption rates is to modify the technology. For example, unlined compost pits are used successfully elsewhere in Senegal and the Sahel. They still require unskilled labor to dig the pit, but as no mason is required, the financial costs are substantially reduced. Villagers indicated during the mini PRAs by the assessment team that a person not wanting to dig their own compost pit could find someone else to dig it for 2500 to 5000 cfa (depending on the size of the pit). During semi-structured interviews, many farmers indicated knowledge and strong approval of composting, but personally chose not to compost because of the high construction costs. Therefore, by encouraging the use of non-lined compost pits, the project would significantly expand the number of potential compost adoptors. Some of the nutrients can leach through the soil, but those who use unlined compost pits still see soil improvement and increased harvest yields.

As there is a much higher adoption rate of compost pits among KAED sites, which promoted unlined pits, than other project sites experienced, it would appear that the perceived benefits of the less expensive non-cement pits warrant more widespread promotion than cement-lined compost pits. Figures cited in several villages indicated that harvest yields almost doubled in parts of fields where compost was applied as compared to non-composted areas within the same field. Even if these figures are slightly high (or if compost was applied more heavily because only a portion of the field was receiving compost) it is clear why villagers adopt this style of compost pit.

At the same time, the number one villager-cited constraint to having an unlined compost pit was the time and effort needed to dig the compost pit itself (Assessment team PRAs in KAED villages, 1999). As a result, a number of KAED villagers had simplified the compost-making process by eliminating the pit altogether, making instead a compost pile.

Surface compost piles also a viable alternative in areas with sandy soils where unlined pits are not practical. The Rodale village of Fissel for example was cognizant and very appreciative of the advantages of compost, but having already rejected the cement-lined pits as too expensive found unlined pits equally unsatisfactory because the sandy walls caved in too readily (Assessment team PRAs/Rodale sites, 1999). The shrub *Guiera senegalensis* however, provides a simple fencing materials for surface compost, and, as seen in KAED sites found in the same geographic area as the CBNRM project, this type of compost pit has been readily adopted by farmers.

The second most important impediment to adoption of compost-making was the amount of time needed to water the compost (Assessment team PRAs 1999). If the compost is made during one rainy season for the following rainy season then the watering could be drastically cut back if not eliminated altogether. All the projects studied for this assessment farmers have been encouraged to make compost during the dry season and use the compost that same year when the rains come. This allows a fairly controlled process of making compost (one knows with certainty how much water is being applied), but does not take into account the extra demands on a farmer's time. By contrast, if making a batch of compost was started late in the dry season (when the farmer is clearing his or her field in anticipation of planting) and allowed to mature during that rainy season and into the next dry season, far less effort would be expended obtaining water. The farmer could let the rains keep his compost pile moist for several months, and then water by hand as needed after the rains end. Once the compost was ready, it could be protected from wind erosion and applied to the farmer's fields the following rainy season. Making compost in this manner takes longer (a full year instead of one dry season), but requires far less of the farmer's time.

In summary, results across projects from the assessment team's PRAs indicate that it is worthwhile to encourage farmers to try less expensive and less intensive compost-making methods including:

- unlined compost pits instead of cement-lined pits or
- compost piles instead of compost pits (particularly in sandy soils), and
- make compost during the rainy season rather than the dry season to reduce amount of hand-watering necessary to take advantage of rains watering the compost pile

Furthermore, the synergy between other activities and compost-making should be considered. Stationary animal fattening, for example, led to increased adoption of compost-making because it was easier to obtain sufficient quantities of manure for compost-making (Assessment team PRA's Winrock sites, 1999).

2.5 Manure

This traditional NRM practice was not actively promoted by any project sites we visited, except Winrock (eg Village of Fissel), so any changes in the knowledge or adoption of manure spreading in the fields cannot be directly attributed to project impact.

Furthermore, as compost is a NRM practice that has been promoted in the past by projects (eg KAED, Rodale, and Winrock) as well as currently (CBNRM), and manure is a necessary component of compost, there is no reason for projects to have also promoted the use of manure in farmers' fields.

It can be argued that farmers interchange compost and manure spreading as the same technique, however if this is the case it still seems difficult to establish what manure spreading can be attributed to any given project as this is a technique farmers have traditionally employed. Thus, this activity is not a useful indicator of any project's NRM impact.

2.6 Improved Seeds

Only one of the seven KAED sites visited, Darou N'Guer, had used improved seed and it was not cited by villagers as a NRM practice they have adopted. In the case of Darou N'Guer, the improved seeds were watermelon seeds used in the demonstration field (KAED Program Records as cited by Eriksen and Miller 1998). Improved seeds were introduced in only three other KAED village demonstration fields, and even then there was only one type of improved seed among several grown crops, so the project's potential impact on improved seed adoption rates is negligible.

Improved seeds have not been promoted by the CBNRM project. As such there is no change in the knowledge, attitudes or use of improved seeds due to this project. Therefore, any impact from this activity within the project zones cannot be directly attributed to the CBNRM project.

Although this activity is not a relevant indicator for measuring the project's NRM impact, CBNRM has a role it should consider. As CBNRM is placing emphasis on becoming a liaison between the NRM committees and other projects for activities CBNRM cannot or does not want to fund, it should also set-up linkages for improved seed sources for villagers. This would foster good will between villagers and the project while requiring no financial and limited time investment from the project.

Winrock successfully increased villagers knowledge of, and appreciation for, improved seeds. Adoption rates were limited only by the supply of seeds available according to villagers; demand consistently exceeded supply (Assessment team PRA's Winrock sites, 1999).

2.7 Improved Cookstoves

Most women, when introduced to improved cookstoves, are quickly convinced of the benefits, namely that they:

- Cost little
- Save significant amounts of fuelwood (30% to 50%)

- Reduce cooking time
- Reduce danger of burns, particularly for young children
- Are easy to construct and repair, ensuring sustainability after project ends.

However, improved cookstoves were not promoted by the CBNRM project during its "micro-réalisation" phase, so there was no impact that can be attributed to the project. CBNRM has expanded the types of activities that will be undertaken with the sub-project phase, and fortunately improved cookstoves is one of those elements. None of the women the assessment team met with had had cookstove training yet, and most did not bring up cookstoves when discussing the types of activities they would be doing under their respective sub-projects.

As such, it is not clear if cookstoves will have an important role in the sub-project phase of the CBNRM project, which would be unfortunate given the high success rate of KAED and other projects have had with improved cookstoves. At a minimum CBNRM could have a significant impact on wood consumption in geographic areas common to both projects (eg Nioro du Rip Department), and realistically, in many other areas of Senegal as well.

Knowledge of improved cookstoves pre-existed the KAED project in some project sites, but the percentage of women aware of cookstoves increased dramatically with KAED's presence. By 1996 69% of the female ABE members were aware of improved cookstoves (Astou Dakano 1997) and 62% of those aware of cookstoves had adopted this wood-saving technique (overall adoption among all ABE female members was 43% in 1997).

None of the other known NRM techniques monitored by KAED had this high of an adoption rate as of the '96 KAP, and certainly none of the wood-producing activities could match the quick impact of cookstoves on the natural resource base; KAED village women interviewed in 1999 indicated their fuelwood consumption was cut almost in half once they started using an improved cookstove. Furthermore, all the women interviewed knew of cookstoves that broke down and had been subsequently repaired. This indicates that:

- the cookstove construction training provided by the project was extremely effective because women remember a year or two later how to re-build a cookstove, and that
- the women had firmly adopted this technique and intend to re-apply their construction knowledge to continue this NRM practice.

By the time of KAED's final evaluation, more than 1,000 cookstoves had been built (Eriksen and Miller 1998). Beyond the marked reduction in fuelwood consumption for 1,000 cookstoves, Africare contributed to significant inter-village information exchange among women. Many of the KAED sites visited had learned how to construct a cookstove from women in another KAED village. In turn, these women were teaching others in non-KAED villages. Not only is this spread effect good for decreasing fuelwood consumption, this farmer-to-farmer training increases village women's sense of empowerment and control

over their lives. Women who are not as pressed for time may be willing to undertake further NRM activities in the future.

Given the insignificant financial investment and the small time requirement needed for cookstove construction training, intensive village-based projects similar to KAED should sponsor multiple cookstove trainings in a given village to ensure virtually 100% awareness of improved cookstoves. The significant wood consumption reduction resulting from cookstove use makes any other course of action incomprehensible for NRM oriented projects.

Literacy courses could be used to reinforce concepts learned in cookstove trainings through the use of hand-outs. These hand-outs should also include copies of improved cookstove training technical forms explaining, in both local language and through drawings, the various steps involved in cookstove construction and repair.

Projects should also consider how to offer more variety in improved cookstoves to meet different women's needs. For women who have extremely limited financial means, clay cookstoves (which cost virtually nothing but often require frequent repairs) are the ideal cookstove, but for other women who are more interested in flexibility for the cookstove's location than they are in cost, a transportable metal stove may be more desirable. As such, a project could encourage local metal workers to fabricate metal stoves, particularly projects such as CBNRM which work on a larger geographic area than village-based projects such as KAED.

In fact, the CBNRM project actually discouraged a metal worker entrepreneur who wanted to introduce women to metal cookstoves. He proposed the project subsidize the cost of the metal stoves for awhile, so women could readily obtain them, and then once appreciation for this new product existed, to sell future metal stoves at a realistic market price. This would allow many women to learn firsthand about the advantages of metal stoves with minimal financial outlay. Once women had seen the relative merits of metal cookstoves to clay cookstoves word of mouth would influence sales of full-price metal stoves.

Also, as women are generally the least affluent in villages, they may need financial help for what would be a relatively affordable expense for many village men. To support widespread introduction of metal stoves during a preliminary period, the project should, for example, consider providing a subsidy to defray stove costs and/or establishing a revolving credit fund to help interested women obtain metal stoves if they preferred metal to clay stoves. By increasing the types of cookstoves available, the project's impact on fuelwood savings would be that much higher.

2.8 Woodlots

The number of woodlots or block plantations due to KAED's presence was not extensive, however they are noteworthy in a couple of aspects. First, many of small woodlots were established by individual women who either already had or were in the process of obtaining formal use rights to the woodlot land. Africare

required usufruct certificates for any women's group establishing a demonstration field, and it appears this prerequisite has affected other NRM activities undertaken by women including woodlots.

Because women did not traditionally ask for formal use rights (they fear they will be perceived as too forward, or even as a societal rebel), the increase in individual women who now possess land certificates suggests that Africare has been a catalyst in changing long-held social mores. Providing this enabling condition is of significant importance because these women landowners will feel more empowered to implement additional NRM practices to improve their land. No longer will they be concerned that extra effort expended on a parcel of land this year will be of no benefit to them when next year they are loaned a different parcel of land. As non-landowner women observe these changes, it is inevitable that they too will want to have formal land use rights, and in turn, be more willing to undertake long-term land improvements.

A project will have trouble enforcing prerequisites which are completely counter to current social mores. However, it would appear that advocating women's land use rights was a concept which rural Senegalese were willing to consider, and as such Africare has had a very positive impact on women's lives. Projects in general should continue to encourage the enabling conditions such as secure land tenure and knowledge of national laws which will enhance future adoption of project-related activities.

KAED provided a second positive enabling condition which undoubtedly contributed to the creation of new woodlots: increased awareness of the new Forestry Code through local language literacy classes. Women account for 78% of the students in Africare sponsored literacy courses, and the Forestry Code was one of the subjects covered in class. Women were uniformly well-informed about the new code in KAED villages and as such were aware that individuals with private plantations have the right to cut those trees as long as they had indicated their intention to do so when first planting the trees. It seems likely that the interest in woodlot plantings can be traced in part to the specific mention of the Forestry Code in their local language literacy courses. If the subject matter is carefully chosen for literacy classes, there will be a positive impact on both the sense of empowerment these individuals experience as well as on other types of activities. Literacy trainings should continue to be used as a conduit for policy awareness-raising particularly for policies which affect NRM activities.

Woodlots, or block plantations, have been extensively adopted within the CBNRM project zones. In particular, during the "micro-réalisation" phase of the project woodlots (along with compost pits) accounted for the majority of activities implemented by villagers. Many villagers learned woodlot techniques during the PRECOBA project era, although not many woodlots appeared to have been established during the period after PRECOBA and before the CBNRM started implementing activities. In general, woodlots have been well implemented with correct spacing requirements respected. The main technical problem concerns the timing of outplanting, but that, it seems, is due more to late start-up dates of the tree seedling nurseries (See Section 2.3) than to villagers' lack of understanding of the importance of outplanting as early as possible in the rainy season.

There has been an overwhelming predominance of *Eucalyptus* woodlots in CBNRM project sites, although the project does suggest three other tree species in addition to *Eucalyptus* on their block plantation technical form. It may simply be that farmers and extension workers need to be encouraged to view the species list found on the block plantation technical form as a suggested starting point rather than a complete, exhaustive list.

CBNRM's block plantation technical form also suggests between 3 m x 3 m and 5 m x 5 m spacing depending upon the species, which works well for all but one of the species listed. If *Anacardium occidentale* is to be grown for both fruit and fuelwood, the suggested spacings are too close to allow fruit production for more than a few years.

In one CBNRM *micro-réalisation* plantation, the women's group had 299 surviving seedlings when 300 were necessary to be reimbursed for expenses. As a result, the women did not receive any reimbursement. The women indicated they were not aware of the 300 minimum survival rate necessary for their field, and also indicated that had they known so, they would have somehow come up with one additional seedling. The women, of course, were very frustrated that they had not received any payment while others had. On the one hand project policies need to be respected (or else where does one draw the line?), but on the other, one seedling is only 0.003% of 300, and regardless if the women were aware or not of the project's reimbursement policies, it is easy to understand their frustration. It is vital that project policies are clearly understood by all project participants from the beginning to avoid negative feelings and confusion about subsequent project decisions.

2.9 Water Erosion Control

Rock bunds to reduce effects of water erosion were promoted primarily by KAED in eight villages. There was minimal adoption in the majority of sites; rock bunds were established in only one demonstration field visited by the team. As such it is difficult to comment on how well villagers were trained in this technique and what aspects might be further enhanced. Women specifically mentioned how labor intensive this work was and had not implemented rock bunds beyond the work they did in their demonstration field.

Rock bunds, although part of several CBNRM sub-projects, had not been extensively implemented when the assessment team did field visits. The few bunds seen were done in individual fields with varying degrees of technical accuracy. Some were quite well done and others appeared to stop just before the edge of a developing ravine. Unfortunately the latter will only result in the ravine shifting positions rather than reducing future erosion. In some of these cases it was not clear if the farmer had received enough technical training to properly establish the contour line. For example, when one village representative was trained in water erosion techniques (at a training outside the village), he did not understand the information sufficiently to teach others.

The technical training being provided to villagers may need to be reinforced. By implementing a monitoring and evaluation system of rock bund training at the village level, the project could verify the quality of information villagers are receiving.

Also promoted in a few KAED sites was *Andropogon*, a grass species often placed on the uphill side of rock bunds to further encourage water infiltration. In Africare sites, *Andropogon* was used instead of rock bunds in areas experiencing mild water erosion, which is a viable technical solution. Again, the number of sites where this technology was needed was limited and the adoption rates within those sites did not spread much beyond the demonstration fields. Villagers at sites using this technique were quite cognizant of the positive impact of *Andropogon* vegetative bands, citing both increased water infiltration and eventual increased soil fertility, so knowledge of this practice and its benefits were an impact of the project. *Andropogon* bands are a useful, inexpensive way to correct minor water erosion problems while also providing useful vegetative matter for lightweight fencing. Other types of plants, such as *Euphorbia balsamifera* or *Vetiver spp.* grasses can be also used to achieve the same protection against mild to moderate water erosion. The disadvantage to *Vetiver* is that it would require direct project intervention to secure seeds, while *Euphorbia* is already found in much of Senegal. Regardless of the type of plants used for vegetative bands, the overwhelming advantage of this method is that it can be done with less effort than rock bunds because no effort is needed to transport and place rocks. For sandy areas where rocks may be unavailable, vegetative bands may be the only viable solution to water erosion.

It is a definite strong point of the CBNRM project that grasses, shrubs and trees are all listed as viable types of vegetation to plant on the uphill side of a rock bund for further protection against water erosion. Unfortunately, individual farmer experiences do not always correspond with this policy. For example, a farmer indicated he wanted to plant *Euphorbia balsamifera*, but was told he had to plant *Parkinsonia acculeata* because he wouldn't be reimbursed for his expenses otherwise - even though this activity took place as a sub-project so no reimbursement of expenses would actually occur. It is not clear how this misunderstanding occurred, but project staff has an interest to both:

- stress how project has evolved in choices so farmers are aware of wide variety of appropriate species to plant uphill from rock bunds, and
- to clarify why farmers are being discouraged from planting *Euphorbia* in conjunction with rock bunds

2.10 Other

Within the KAED zone, increased tree planting is occurring in women groups' collective fields within the project zone and is spreading to other villages. The traditional limitations on women owning land appear to be changing, facilitated in part by project insistence that the women's groups obtain official usufruct certificates to their collective/demonstration field(s). Also, in several other cases individual women had also recently received formal land use rights to individual plots of land. Women's groups outside project sites

were establishing similar demonstration fields, and obtaining formal land use rights as well. It is not clear if individual women were obtaining usufruct certificates at non-project villages at the same rate as within the KAED zone.

Sometimes an individual woman's usufruct certificate was due to an inheritance, but in most other cases it appeared to be a fundamental shift in the original landowner's view of women and their ability to manage land. If these examples prove to be indicative of a change towards social acceptance of women having formal land use rights, it is reasonable to assume that women's active management of land will also increase accordingly. As such, these changes are very positive and efforts to encourage additional formalized land use rights for women should be enhanced.

3.0 Findings & Recommendations for Future NRM Activities

This section focuses specifically on the technical aspects of the NRM activities discussed above. It is intended to be read in connection with the companion annexes of this report since the author makes minimal mention of project approach questions (participation etc.) given that these issues are addressed in other annexes.

3.1 Live Fencing

NRM projects regularly promote live fencing as an inexpensive and biomass enhancing alternative to metal fencing. This activity has had generally moderate to poor success for a variety of reasons, both technical and logistical, which can often be resolved through improved project performance.

One technical difficulty seems to be the confusion that exists between what is a live fence versus a windbreak. Trees to form a live fence are often planted too far apart (one or two meters) to provide a barrier to animal intrusion whereas windbreak trees are planted too close together, creating a vegetative wall rather than a partial sieve.

In fact, what is often referred to as either live fences or windbreaks seem rather to be field demarcation plantings, since plant spacings observed often do not serve either of the first two functions.

Recommendation: Project personnel need to clarify the difference between live fencing and windbreaks.

Recommendation: Reduce spacing between live fence to 15 cm to 1/2 meter depending on species used.

Both activities serve important, but distinct, purposes and require separate technical approaches. Live fencing is not needed for most rainy season fields as animals are not allowed to roam freely during this time of the year.

Recommendation: Only promote live fencing if the crops being planted in the area being protected are of high enough value to justify the time and expensive required to plant and maintain the live fence.

Euphorbia balsamifera, a popular plant material for live fences, is a good choice for live fencing for the following reasons:

- it is planted in the dry season and therefore planting does not compete with other farmer activities during the busy rainy season
- it establishes quickly if no trampling damage sustained between planting and rains
- it is an effective beginning/first step in live fence development

Thorny tree species selection to be planted in combination with *Euphorbia* include several effective multi-purpose trees such as *Ziziphus* and *A. nilotica* which can be used to generate additional revenues (pods of *A. nilotica*, fruit from *Ziziphus*, etc.).

Recommendations: Combine *Euphorbia balsamifera* with multi-purpose thorny species to create a more effective live fence than one species alone.

Recommendation: Projects should encourage the need to use dead fencing material *as a short-term measure* to fill in gaps while thorny species establish themselves.

Some supplemental dead fencing to fill in gaps while thorny species establish themselves is acceptable. Filling gaps avoids crop damage from animals without causing a multi-year delay in whatever is to be grown within the enclosure.

Recommendation: Project need to reinforce the reality that establishing a live fence is a multi-year activity. Adopters will need to follow-up with replanting live fencing material and fixing dead fencing over a several year period.

As mentioned above, moderate use of dead fencing to complement live fencing is acceptable but use of dead fencing back-up should be reduced each year as live fence gaps diminish.

3.2 Field Trees

Field tree plantings, where trees are intercropped with agricultural crops, are an effective way to increase vegetative biomass in a socially acceptable way. For example, because of increasing population pressures, fewer farmers own sufficient land for their agricultural needs, so despite decreased soil fertility (of which all farmers are aware), it is increasingly difficult to find farmers who are able to convert whole fields to block plantations (thereby taking that field out of crop production) or even who can remove edge sections in order to establish effective windbreaks. As a result, field tree plantings will continue to grow in importance as a NRM technique.

Protection of natural regeneration has the same ultimate goal as field tree plantings, and is an increasingly popular NRM activity, particularly for nitrogen-fixing species. For example, the increased discussion about utility of kadd trees, even in zones where *Acacia albida* has not traditionally existed is a positive trend

occurring in Senegal. At the same time, protection of natural regeneration, perhaps due to its simplicity, is still an under-utilized technique and should continue to be encouraged.

Farmers often prefer this method to tree planting on their fields because:

- unlike tree outplanting, staking, painting or flagging to protect naturally regenerated seedlings or trees can be done prior to the busy agricultural season,
- it requires less effort to protect existing seedlings or trees than to grow, outplant and protect new seedlings, and
- there are none of the costs associated with a nursery (purchase of pots @ 15 cfa/pot, chemicals, seeds, fencing for nursery, nursery labor for 2-6 months etc.)
- there are higher survival rates - a naturally regenerated seedling that has survived on its own is less likely to die than a newly planted seedling straight from the nursery

3.2.1 Protection of Natural Regeneration

Recommendation: Conduct an analysis of the Jig-Jam Association protection of natural regeneration project in the Fissel arrondissement to determine how its success can be replicated. The initiative combines a low-cost implementation scheme with decentralization of authority from the Forest Service to villages to achieve significant and sustainable results.

Recommendation: Increase promotion of protection of natural regeneration in farmers' fields rather than tree plantings.

In addition to its nitrogen-fixing properties, *Acacia albida* loses its leaves during the rainy agricultural season so it does not compete for sunlight with agricultural crops which is an added benefit. For farmers who are already paying herders to have their herds manure their fields, feeding the cattle kadd seed pods prior to bringing them to the fields is a small additional step, but that will have longer term benefits for a field's soil fertility as the scarified kadd seeds have a higher probability of germinating.

Recommendation: Protection of natural regeneration emphasis should be placed on nitrogen-fixing species such as kadds to increase soil fertility. To encourage additional regeneration of kadds, cattle should be fed *Acacia albida* seed pods prior to being bedded down in a farmer's field. The manure will contain partially scarified kadd seeds, encouraging kadd regeneration.

Protection of natural regeneration activities can range from the extremely simple to a somewhat more involved process. At its easiest, farmers can leave seedlings rather than remove them as they prepare their fields for the rainy season. To ensure that they see the seedlings when plowing, farmers could paint them or tie on bright flagging. Finally, another level of effort would be to prune off lower branches and then stake the seedlings to encourage upright growth, thereby increasing visibility in a couple of years to a farmer who is plowing. Selective pruning and staking will also encourage upright growth rather than spread, which is a more convenient tree form for a farmer intercropping agricultural crops with trees.

Recommendation: As farmers adopt protection of natural regeneration, encourage them to enhance survival rates and to improve tree form by pruning lower branches off the protected seedlings.

Spacing requirements for protection of natural regeneration is similar to field tree plantings, that is, based on the requirements of specific tree species, but a goal of 60 - 70 trees is a good general rule. Natural regeneration, of course, will occur randomly in a field, so a certain amount of flexibility is needed when determining how many and which trees to protect; it is better to have fewer trees that are well dispersed than to have 70 seedlings concentrated in one corner of a field. Also, if the goal is to have a constant supply of multi-stemmed shrubs/small trees, the total number of trees protected could easily be higher.

Whenever possible, the emphasis of protection of natural regeneration should be placed on nitrogen-fixing species to increase soil fertility. To facilitate additional regeneration of kaddis, cattle should be fed *Acacia albida* seed pods prior to being bedded down in a farmer's field. The manure will contain partially scarified kadd seeds, encouraging kadd regeneration.

3.2.2 Windbreaks

Numerous beginnings of windbreaks were observed by the team, and are added to as farmers obtain sufficient cash to buy seedlings. There is extensive use of fast-growing tree species for windbreaks including *Eucalyptus* and *Acacia holosericea*, which ensures quick establishment of a windbreak. Unfortunately, *Eucalyptus* has a lot of surface roots which means there will be more water competition with crops than other tree species might cause. The main disadvantage of *A.holosericea* is its short life span, usually no more than 14 years.

Recommendation: Promote the discussion of need for longer-lived species to be planted at same time or shortly after establishment of *A.holosericea* to increase the length of impact of existing windbreaks.

Recommendation: Reinforce technical comprehension of effective windbreaks including suitable spacing: five meters between trees and three to five meters between alternating spaced rows depending on species.

3.2.3 Species Selection

Project staff tend to view trees in reductionist terms, i.e. as a live fence, windbreak, source of construction wood, or for nitrogen-fixing properties. The PRA assessment reconfirmed that farmers have a much more integrated perspective when evaluating tree species which must be integrated into project activities.

Recommendation: As with all NRM techniques using trees, projects need to collaborate with farmers to evaluate species selection in terms of their potential for multiple uses.

Recommendation: Collection technical information concerning the nutritional value of *A.holosericea* seed pods and the multiple value-added food products which can be produced using the pods. Such technical information is available through contacts at USAID/Niger for example.

3.3 Tree Seedling Nurseries

This does not exist as an indicator for the R4, however, as several of the NRM activities' success are directly linked to the quality and production timing of nurseries, it is important to examine how they have been managed.

In general throughout the Sahel, there is a tendency to associate tree planting with National Tree Day, which unfortunately does not occur until early August in most Sahelian countries, including Senegal. As a result, many nurseries base their seedling production on a start-up outplanting date of early-mid August too. If National Tree Day is used as the starting date for planting, there will often be several weeks before all trees are planted as farmers also have time commitments for their agricultural crops. Late August/early September is well into the rainy season, and so it is quite likely that these newly outplanted seedlings will receive only a couple of rains before the season ends. National Tree Day can be a time to do symbolic tree planting, and perhaps a tour of well-planted seedlings from a few weeks prior.

Recommendation: Massive outplantings should be disassociated with National Tree Day as this is generally too late for outplanting to start. Start-up dates for tree nurseries should also be moved up accordingly.

Other than the late start-up date, most nursery managers show a good understanding of general nursery techniques including appropriate soil mixture, filling plastic pots, seed scarification and seed sowing, watering regimes, etc., and were moving more and more to selling seedlings, particularly fruit trees, in local markets.

Fruit trees are generally easy to sell in local markets, providing a steady revenue source. Grafted trees provide a higher return since they will produce higher quality fruit as well as early or late bearing varieties which avoid over-saturated markets.

Recommendation: Promote nursery production of fruit trees, particularly grafted fruit trees, in zones with adequate water table levels, ensuring sufficient training and post-training monitoring to result in continued fruit tree grafting after project completion.

3.4 Compost

Compost does not necessarily require cash outlays as high as those for fertilizer, thereby increasing access to cash-poor farmers (particularly if a non-cement lined compost pit is promoted). As a result this NRM activity is a very positive technique for projects to promote. Farmers the team met with reported similar or higher crop yields in compost test plots as compared to fertilizer test plots. Furthermore, farmers were pleased with the relative safety of compost: well decomposed compost does not burn crops as fertilizer can, and less-decomposed compost had a multi-year effect (estimated from 3 to 5 years). In general, this impact of this activity is well understood and appreciated.

Recommendation: Continue to encourage farmers to make and use compost on their agricultural fields.

However, to increase the number of people who adopt compost-making as an activity, one needs to increase the accessibility of this activity to a larger group of people; a balance between the ideal technical solution and the socio-economic reality of rural Senegalese is needed for widespread adoption. One of the ways to do this is to reduce the time and money inputs necessary to produce compost. Some of these variations will lead to fewer nutrients ending up in farmers' fields. However, if this means someone who has previously been unable to adopt this practice can now afford to compost, the partial loss is compensated by the overall increased use of compost.

Recommendation: Decrease reliance on or promotion of cement-lined compost pits. The cash requirements for this style is out of reach of most farmers, and in attempts to save money on cement costs, most cement-lined compost pits we saw were already starting to fall apart after only a year or so use.

Recommendation: Increase promotion of unlined compost pits in clay soils.

Recommendation: Increase promotion of surface compost piles, particularly in sandy soils where unlined pits would cave in. Establish simple fencing (using for example *Guiera senegalensis* branches) for surface compost.

If a project wants cement-lined compost pits as part of the choices available to farmers, one must recognize that they are financially out of reach for the majority of farmers; most of the farmers we visited who had cement-lined compost pits had other jobs (Alphabetization instructor for another project, etc) and as such had a sufficient outside cash flow to allow them to use this technology. Targeting only those people with outside means will not lead to widespread adoption of compost. Cement-lined compost pits did create a spread effect in some cases, but for surface compost rather than cement-lined pits.

Recommendation: Allow establishment of credit program so those interested in cement-lined compost pits can defray them over a period of time, with loan repayment occurring after the first harvest where compost was used.

Based on results from the PRAs done by the assessment team, it is obvious that the time required for watering compost and for transporting compost to the fields are a major constraints to adopting this activity. It is clear adoption rates can be significantly increased if these time demands were eliminated or reduced.

Recommendation: Look upon donkey carts as a NRM tool. Facilitate a credit program that would allow groups or individuals to purchase carts for compost transport. Loans would be payable after the harvest using compost.

Recommendation: To better accommodate farmers' time constraints, change compost-making season from dry season to rainy season to reduce or even eliminate necessity of hand-drawing water for compost pile. Compost would then be applied in the fields the following rainy season.

3.5 Manure

Manure spreading is a traditional practice known and familiar to farmers. As such it will always be difficult to attribute adoption rates to a particular project.

Recommendation: USAID should discontinue using manure as an indicator for natural resource management adoption rates.

3.6 Improved Seeds

Based on PRA's conducted by the assessment team in WINROCK and Rhodale sites, it was apparent that improved seeds are highly regarded by farmers, more seed would be used if available, and a "revolving credit" management system works well for seed re-payment after harvest. The flexibility shown from area to area as to how high the pay-back in seeds should be allows one to take into account the local ability to pay versus the local demand for the seeds. The revolving credit approach allows sustainability in the short-term, however as improved seeds can only be passed on for approximately three generations before an infusion of new improved seed is required, a longer-term solution is needed.

Recommendation: Encourage establishment of a formal, improved seed distribution system through the private sector to ensure long-term sustainability of improved seed use.

3.7 Improved Cookstoves

Overall, the promotion and adoption of improved cookstoves is a strong success across projects. Most villages surveyed during this mission indicated almost universal adoption, and several mentioned that they were the source or recipients of cookstove training techniques in or from surrounding villages, which indicates a strong spread effect is occurring.

There is good reason for the high adoption rate of cookstoves among those introduced to the practice. After all, cookstoves:

- Cost little
- Are easy to repair (and repair techniques are easily mastered by stove owners ensuring sustainability)
- Reduce the need for fuelwood by at least 1/3, and according to most women interviewed, the savings often is closer to 1/2, and
- Reduce cooking time, reduce danger of children falling into cooking fire, reduce danger of women's clothing catching fire, reduce amount of detritus which blows into cooking pot, etc.

In short, the huge time savings these cookstoves represent to women help explain the high adoption rate. Furthermore, projects should be equally enthusiastic about increasing the adoption rate of cookstoves - the 33-50% reduction in adoptees fuelwood consumption undoubtedly has a more positive impact on maintaining/improving tree biomass levels than the reforestation efforts so heavily promoted by projects in the same zone.

Recommendation: Projects and USAID should make the promotion of improved cookstoves among their highest NRM priorities particularly in the short to mid-term.

One of the very few drawbacks of cookstoves mentioned by women is the need to repair clay cookstoves, and for that they need to wait until after the seasonal ponds start to recede before they can get clay for repairs. Consequently mobile stoves or stoves made out of metal would not have this disadvantage. While many women will prefer a clay cookstove because they can make it themselves, there are women who would be willing to pay for a metal stove in order to avoid annual repairs.

Recommendation: Encourage production of additional cookstove styles in order to appeal to an even wider audience. Specifically, promote metal cookstoves in addition to clay cookstoves.

Construction of metal stoves could easily evolve into an income generating activity either for an individual metal worker, or coordinated by a women's group. The women contract with a metal worker to make a certain number of stoves, and then sell them in local markets either at full price, or at a reduced rate on credit. Interest from this short-term loan would be rolled back into the women's fund.

Recommendation: Provide training for local metal workers to learn how to construct metal cookstoves.

Recommendation: Add a revolving credit program for women to facilitate stove purchases and/or facilitate women groups establishment of their own stove credit program.

3.8 Woodlots

Woodlots have been promoted for years in numerous villages so many farmers are quite familiar with this NRM technique. As a result, they are generally technically well executed, with a preponderance of *Eucalyptus camaldulensis* being planted. It is interesting to note that when *Eucalyptus* was first planted in Senegal, many women objected to using it for fuelwood because of the acrid smoke, so it was grown almost exclusively for construction wood. Yet it is clear that over the years more and more women are willing to use *Eucalyptus* wood for cooking so woodlot production now goes to both construction and fuelwood needs.

Because of the demand for cultivatable land however, woodlots are not always feasible. Farmers in the areas the team visited discussed the increasing difficulty of having fallow fields. Block plantations, unlike border plantings or other configurations, require a quasi-permanent land-use change from agriculture to tree production. Growing land pressure suggests that fewer and fewer farmers will be able to convert entire fields to tree production and still meet their agricultural needs, particularly in the coming decades (Gray Tappen, personal communication). The possible exception to this is older farmers who have more land than they can reasonably actively farm, and find tree production as a convenient labor-saving way to continue maintaining productive use of their land. As such, they will avoid accusations of having "abandoned" a parcel of land (and potentially having it re-assigned to someone outside the family), while ensuring a lower, but easier income flow than other crops as they age.

Recommendation: Recognize that due to increasing land pressure, woodlot or block plantations will be less likely to be adopted by farmers in the future, and as such emphasize other NRM activities instead of woodlots.

3.9 Erosion Control

Numerous beginnings of rock bunds are occurring, particularly in the Saloum area of Senegal. This is an important activity given that water infiltration is often a problem during the heavy but brief rains typical of the Sahel. It is also a difficult activity to undertake, requiring a lot of labor, and in many cases, coordination between neighbors.

Recommendation: To encourage farmers to participate in rock bund construction tie in this long-term activity with one which will produce results in the short-term, for example, improved seeds.

Recommendation: Provide credit programs to facilitate purchase of carts which can be used for transport of rocks.

4.0 Summary of Implementation Recommendations Specific to The CBNRM Project

General Observations. The types of activities noted in the *LUMP* are wide-ranging (sometimes almost excessively so) yet the activities being implemented as observed by the assessment team are generally much more limited. The CBNRM project has had a very narrow definition of what constitutes a NRM activity, and would profit by widening the definition to include other activities. Because the management of natural resources tends to have a very long-term focus, it seems particularly important to include activities that have either an impact in the short to mid-term and/or that are income generating activities linked to more traditional NRM activities. Without these changes, adoption rates will be limited; farmers may be aware of the long-term benefits of various NRM activities, but by necessity they are more interested in what they can do to improve their lives in the short-term.

Many of the comments noted here cover very basic technical suggestions, and for the most part are based on first generation CBNRM project sites. Although quite simple in nature, without these improvements there will be few positive NRM impacts at the end of the project. Thus, it is necessary to improve the quality (or possibly just the quantity) of technical information given to villagers without reverting to a top-down driven program. It has not been, nor should it be, project staff's role to directly provide these technical trainings, but rather to assure that the quality they desire is being offered by the CERPs and other technical providers; the quality of NRM technical information being disseminated under the project's aegis will ultimately impact the project's long-term effectiveness.

As the assessment team spent the majority of field visits in first generation sites, some of the recommendations listed here may already be under review by project staff for future NRM activities. The CBNRM project staff have shown themselves willing to modify various organizational and management training policies of the project, and it is reasonable to assume that technical improvements are also being undertaken.

4.1 Live Fencing

Recommendation: Continue to provide technical guidance to ensure spacing norms for live fencing are respected.

Recommendation: Conduct sporadic technical monitoring and evaluation to verify quality of information farmers are receiving from CERP teams and others providing technical training and information at the village level. Provide follow-up training and/or feedback to training providers if incorrect or incomplete information is being given, as appears to be the case with live fencing.

Recommendation: Encourage farmers to employ more than one species in the establishment of live fencing (for example easily established *Euphorbia* in combination with a slower-growing thorny tree species) to ensure the best long-term protection within the perimeter.

4.2 Field Trees

Recommendation: Conduct an analysis of the Jig-Jam Association protection of natural regeneration project in the Fissel arrondissement to determine how its success can be replicated in CBNRM sites. The project combines a low-cost implementation scheme with decentralization of authority from the Forest Service to villages to achieve significant and sustainable results

Recommendation: Revise technical form for Field Tree Plantations to meet technical recommendations while also providing the easiest outplanting configuration for farmers using animal traction. Changing from 10 m x 10 m spacing to 5 m x 20 m allows same biological benefits, but also accommodates farmers' needs.

Recommendation: Add protection of natural regeneration as a separate NRM activity since it is easy to learn, extremely low cost, requires few or no inputs not already owned by farmers, and survival rates are very high (as natural regeneration trees have already survived beyond the high mortality of a tree's first year). Protection of Natural Regeneration is an extremely efficient way to contribute to increased wood production.

Recommendation: Incorporate protection of natural regeneration as part of the field trees activity for any desired species existing within that zone as these trees will cost less per tree and will have higher survival rates than nursery-grown trees.

Recommendation: Re-emphasize spacing norms for windbreaks, that is, five meters between trees and 3-5 meters between rows if a second row of shorter trees is included. Technically ideal windbreaks requiring four rows of trees are unlikely to be adopted due to land use pressures, and as such should not be over-emphasized.

Recommendation: Stress importance of establishing windbreak perpendicular to the wind to avoid a tunnel effect. Directions perpendicular to the wind should always have first priority, even if a farmer ultimately wants to surround his or her whole field.

4.3 Tree Seedling Nurseries

Recommendation: Modify nursery technical form to explicitly discuss timing requirements for various tree species.

Recommendation: Establish regional nursery calendars based on targeted outplanting date (ie after first good rain); count backwards from when first good rain falls (late May to early/mid-July depending on CBNRM zone) and then count backwards to arrive at date a particular species must already be sown in the nursery. Timing for all other nursery activities (establishing nursery beds, filling pots, watering/weeding pots prior to sowing, seed scarification, etc.), should also be included and counted back to arrive at start-up dates for individual nursery aspects.

Recommendation: Project staff should resolve bureaucratic impediments to tree nurseries and other NRM activities as quickly as possible to avoid negatively affecting tree survival rates.

Recommendation: Add a "Selection of Species" sub-heading to the technical form. This sub-heading should stress importance of meeting with people who will purchase/take seedlings from the nursery to create list of species and quantities to grow this year. The nursery manager should base his or her nursery on what the customer wants, not the other way around.

Recommendation: Reduce over-reliance on tree seedling nurseries (and their accompanying problems) by substituting protection of natural regeneration for outplanting wherever possible.

4.4 Compost

Recommendation: Allow establishment of credit program so those interested in cement-lined compost pits can defray their cost over a period of time, with loan repayment occurring after the first harvest where compost would be used.

Recommendation: Promote use of unlined compost pits for clayey soils as a viable alternative to the more expensive cement-lined compost pits.

Recommendation: Promote use of surface composting for sandy soils as a viable alternative to the more expensive cement-lined compost pits.

Recommendation: To better accommodate farmers' time constraints (and thereby increase likelihood of adoption), change compost-making season from dry season to rainy season to reduce or even eliminate necessity of hand-drawing water for compost pile.

4.5 Manure

Recommendation: USAID should drop this technique as an indicator. This practice is/was not actively promoted by any projects under SO2, and as applying manure is a traditional NRM practice, it would be very difficult to attribute any changes in adoption levels to project impact.

4.6 Improved Seeds

Recommendation: Set-up links between farmers in CBNRM zones and Winrock/Peace Corps' Seeds for Trees program.

4.7 Improved Cookstoves

Recommendation: Actively promote cookstove construction in all project zones by providing or organizing multiple cookstove construction and maintenance trainings for village women. Given the significant reduction in fuelwood consumption coupled with the low cost of village-based trainings, it is inexcusable not to make this a top priority.

Recommendation: Encourage metal workers to produce metal cookstoves (as well as the project promoting clay cookstoves) to assure that a variety of cookstove needs can be met. To support widespread introduction of metal stoves during a preliminary period, the project should also consider providing a subsidy to defray stove costs and/or establishing a revolving credit fund to help village women obtain metal stoves.

4.8 Woodlots

Recommendation: Implement a monitoring and evaluation system to spot check the quality of technical instruction being provided to farmers. Specifically, ensure outplanting dates for woodlots are done early in the rainy season to enhance seedling survival rates.

Recommendation: Encourage farmers and extension workers to view the short species list on the block plantation technical form as a suggested starting point rather than a complete, exhaustive list.

Recommendation: Ensure that project policies are clearly understood by all project participants from the beginning to avoid negative feelings and confusion about subsequent project decisions.

4.9 Erosion Control

Recommendation: Reinforce technical training provided to villagers in proper establishment of rock bunds.

Recommendation: Establish and implement monitoring and evaluation system of rock bund training at village level to verify quality of information villagers are receiving.

4.10 Other

In general villagers have kept the numerous documents they had received from the project, but as most villagers cannot read French, there often was confusion as to what the documents actually said. By providing local language literacy trainings and translating technical and project information into a form usable for villagers, they become more actively involved and empowered.

Recommendation: Conduct local language literacy trainings at village level as precursor to project activities.

Recommendation: Create technical notes (*fiches techniques*) in national languages, and possibly in Arabic for various technical subjects pertinent to project activities. Project staff should work with the CGRN, CERP and *animateur* to determine who will be responsible for the distribution of these notes to both the *zone promoteur* and to the villagers actively involved in that type of work.

Recommendation: Incorporate project technical forms, National Forestry Code and other NRM related information into literacy trainings to reinforce information learned in technical trainings.

Having project staff conduct sporadic quality control of technical trainings from villagers' perspectives would serve as useful part of a feedback loop for project staff. This could include a verbal description from the villager who was trained as to what he or she specifically learned, viewing how the villager applied the information him or herself, and asking others who were taught by that villager to do the same thing. This should be done individually, not in groups so as to ascertain what information is being correctly understood and what areas that may need future reinforcing by the CERP team.

Recommendation: Have the M&E section of CBNRM conduct Customer Satisfaction Surveys to include the depth and appropriateness of technical training delivered to villagers using the villagers' perspective.

Finally, many villagers said they were encouraged to plant *Eucalyptus* trees in somewhat saline soils. The rationale indicated to villagers was not only is *Eucalyptus camaldulensis* salt tolerant, that it will remove salts from the soil, thereby allowing the land to be used for other activities such as gardening. While *E. camaldulensis* is somewhat salt-tolerant, it cannot remove salt from soil (Michael Shannon et al. 1998; personal communication with Ann Gibson, Department of Forestry, Australian National University). Low-lying areas with saline soils will not be reclaimed by *Eucalyptus camaldulensis* for future gardening, at least

not with the variety used in tropical parts of the world (There is some hopeful research in this area for a variety of *E.camaldulensis* grown in temperate climates). Project staff need to correct the source of this misinformation to retain credibility with villagers. Furthermore, the project should ensure that villagers understand the limitations of *Eucalyptus*.

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Task Order No. 825
Contract NO. PCE-1-00-96-00002-00

Annex C.

Farmer-perspective Financial and Economic Analysis

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March 1999

For
USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

Partners: International Resources Group, Winrock International,
and Harvard Institute for International Development

Subcontractors: PADCO; Management Systems International; and Development Alternatives, Inc.

Collaborating Institutions: Center for Naval Analysis Corporation; Conservation International; KBN Engineering and Applied Sciences, Inc.; Keller-Bliesner Engineering; Resource Management International, Inc.; Tellus Institute; Urban Institute; and World Resources Institute.

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Acronyms

ABE	Agriculture-Based Enterprises
CERP	Centre d'Expansion Rural Polyvalent
CBNRM	Community-Based Natural Resources Management
CNCA	Caisse Nationale du Credit Agricole
EPIQ	Environmental Policy and Institutional Strengthening Indefinite Quantity
GIE	Groupement Intêret Economique
GOS	Government of Senegal
HH	Household
ISRA	Institut Sénégalais de Recherches Agricoles
KAED	Kaolack Agricultural Enterprise Development
KAP	Knowledge, Attitudes, and Practices (Survey)
KIR	Key Intermediate Result
MARP	Méthode Active de Recherche Participative
NEAP	National Environmental Action Plan
NGO	Non-Government Organization
NRBAR	Natural Resource-Based Agricultural Research
NRM	Natural resources management
OFPEP	On-Farm Productivity Enhancement Program
PAGT	Plan d'Aménagement de Gestion de Terroirs
PRA	Participatory rural appraisal
PVO	Private Voluntary Organization
R4	Results Review and Resource Request
SO	Strategic Objective
SODEVA	Société pour le Développement et la Vulgarisation Agricole
SOW	Scope-of-Work
SRP	Senegal Reforestation Project
SZWM	Southern Zone Water Management
TOR	Terms of Reference
USAID	US Agency for International Development

1.0 Introduction

1.1 Background

The overall purpose of the: “Impact Assessment for the USAID/Senegal AG/NR Strategic Objective No. 2” is to determine if USAID’s NRM investments during the life of the NRM SO have had any sustainable positive impact. If so, there is strong argument for continuing to support NRM through CBNRM (and other activities to be added to the Mission portfolio in the future) to ensure that the NRM technologies are promoted and adopted on a larger scale throughout Senegal. To do so, however, the technologies should first be subjected to financial and economic analysis to determine if they are sufficiently attractive to the intended beneficiaries without any further outside financial support from donors in the forms of subsidies, matching grants, or other direct financial incentives, other than technical assistance only. Such an economic focus is almost universally missing from USAID’s NRM portfolio with the exception of only a few cases¹⁵. Most of the technologies have been promoted on the basis of their biological and environmental benefits, only *assuming* that they are financially and economically feasible as well. This lack of explicit economic focus hinders the desired spread effect of the NRM technologies throughout Senegal as farmers are not well informed about their relative financial attractiveness in which they are invited to participate.

The background for the financial and economic analyses developed in this report is well summarized in the conclusions and recommendations section of the USAID/Senegal Limited Natural Resource Management Impact Assessment (Christophersen et al, 1998):

“Although USAID/Senegal’s NRM portfolio can demonstrate (with the KAPs and project mini-KAPs) that the rate of degradation of Senegal’s natural resource base is slowing down, it remains largely unknown if yet additional positive economic impacts could not have been achieved if the NRM practices promoted had been subjected to rigorous financial and economic analysis from the perspectives of the intended beneficiaries. There is a general absence of an explicit emphasis in the NRM portfolio of activities on knowing the economic and financial realities of the NRM practices extended. It is implicitly assumed, for example, that if farmers implement NRM practices X, Y, and Z, then these practices must be financially feasible, otherwise farmers would not implement them. This assumption is valid only to a limited extent, however. The practices extended to and adopted by the farmers may be and probably are financially feasible, but it is not known if the specific configurations of these practices are the most attractive ones from the farmers’ perspectives. It should be important for the extension workers to be aware of the economic realities of different technical configurations

¹⁵ Some scattered (and not well distributed) efforts have been made, including: a) Aïfa Fatimata Ndoeye and Aminata Faye who recently (1998) analyzed composting activities from both the socio-economic and economic perspectives, b) G. Edward Karch who carried out financial analysis of different agroforestry and forestry activities for the USAID Reforestation Project in 1991, and c) Michael Satin (1997) who carried out financial analysis of live fencing and windbreak technologies in the Kaolack region. None of these efforts included any aggregation scenarios in accordance with development targets to project the impacts on farmer incomes and/or volumes of commodities produced.

of the same NRM practices. Live fences, for example, can consist of euphorbia plants which is the dominant type of fence seen all over Senegal, and the type of fence usually extended. These fences only provide protection, however, and they typically attract snakes—a side effect not much appreciated by the farmers. There are many different technical live fence configurations which do not attract snakes, which require different levels of investments and maintenance regimes, and which also generate other commercially valuable products such as fuelwood, poles, and fruits. These technical alternatives should be known by the extension workers in terms of both their biological and economic advantages and disadvantages. Once the participatory approach has recommended live fences as a favored NRM practice in the village, therefore, the automatic technical answer for implementation, therefore, should not always be the euphorbia fence, but include other technically sound options as well, which pass the test of farmer-perspective financial feasibility.”

USAID NRM SO 2, KIR B indicators provided the guidance for the kinds of interventions to subject to farmer-perspective financial analysis. These included both the current and proposed indicators as discussed in the limited assessment report (1998). Brief summary descriptions of selected indicators analyzed are provided below.

1.1.1 Composting

Of all the NRM technologies promoted by USAID and others, composting is probably the one most difficult to convince farmers to adopt. There are many well published constraints to adoption, including lack of water, biomass and manure, the financial means to build the compost pits, the means of transport to haul water and biomass to and from the pits, and lack of phosphates and improved seeds to complement the composting (Faye 1998 and Ndoeye 1998). Farmers, therefore, are generally reluctant to adopt unless project subsidies are generous – the bottom line is that the rate of adoption has been far short of spectacular. Few will implement unless donors pay them to do so.

Economics aside, composting is important because it addresses the fundamental problem of soil fertility in the most comprehensive way. Windbreaks, rock dikes, and live fences are NRM technologies of considerable proven merit, indeed, but they are of limited value unless the structure of the protected soils are also improved through composting and/or manuring techniques. Likewise, the promotion of improved millet seeds has little meaning unless it is done in combination with a much improved soil fertility management such as composting, and to a lesser degree, manuring. Although farmers will typically lament the withdrawal of subsidies for chemical fertilizer as the main reason for the low yields, their awareness of the possibilities offered by combining (less) chemical fertilizer with organic compost remains low. They willingly participate in project-sponsored composting schemes only if the direct incentives are attractive (i.e., the project pays for the construction of the cement pits and provides the needed equipment). They will rarely make the necessary investments on their own.

A major missing ingredient to adoption, it is hypothesized here, is the absence of information on the economics of composting by physically demonstrating the differences between composted and non-composted fields and translating these differences into direct impacts on farmer incomes. Farmers are well aware that composting increases crop yields, but not whether the returns justify the investments required

(labor and/or cash) if subsidies were not available. Moreover, if one were to determine the economics of dry season composting when the constraints are most imposing, it would probably show up less attractive than other technologies. Dry season composting has been promoted more so than wet season composting with scant attention paid to resolving some of the most troublesome constraints. If some of the major constraints were removed as briefly discussed below, the economics of composting could be more attractive and the rate of adoption should increase, all else being equal, particularly if farmers were provided the opportunity to make economically informed decisions. The following several points are based on interviews with ISRA/Bambey researchers who claim to have the “solutions” to most of the constraints to composting. If these indeed are realistic solutions, then the prospects for composting should be bright because: a) they would reduce costs, and b) increased adoption would be a function of including the technical cost-reducing nuances into the extension packages for the farmers. Field observations, however, clearly indicate the opposite. The analysis presented in this report will reflect different kinds of composting schemes, ranging from the traditional to the more complex cement pit composting techniques.

- **Water constraint:** Researchers claim that composting during the rainy season rather than the dry season is eminently feasible if farmers would only change their factors of production slightly. Rainy season composting would reduce the need for watering to nearly zero. The conventional wisdom against this is that labor is very much occupied during the rainy season and would not have the time to spend on preparing the compost pit. If, however, the pit has already been constructed, the process of filling it is not that time consuming – most of the work required falls within the scope of preparing the fields at the start of the rainy season. A part of this work involves raking up the remaining crop residues from the previous season into piles, which are typically burned. Instead, these residues could be used for composting during the rainy season and be ready for application next year.
- **Availability of biomass:** According to ISRA, this is much less of a constraint than usually claimed. A typical millet hectare will contain five to six tons of crop residues which is gradually used over time for different purposes. On top of the list is the extraction of the highest quality millet stalks for the construction of fences around the village compounds (palisades)¹⁶. This is followed closely in priority by livestock grazing of the remaining millet stalks either directly in the field, or on a cut and carry basis. The remaining *uncontested* volume of organic biomass per hectare (for which there *currently* is no market) at site preparation time is estimated to be approximately two tons per hectare. This biomass is usually collected and burned as part of the site preparation – it could, instead be used for composting. The millet production area in the Kaolack region, for example, amounts to some 332,000 hectares (Bucknall et al, 1997), or roughly equivalent to 664,000 tons of uncontested biomass available for composting (if ISRA’s estimates are correct), far exceeding the biomass currently used in project supported composting schemes. At an application rate of

¹⁶ In fact, there is a fairly thriving market for high quality millet stalks sold in “bottes” for 250 FCFA each. One hectare is estimated to contain 100 such bottles, or a total value of 25,000 FCFA.

(the suboptimal) two tons of compost per hectare¹⁷, this available volume could potentially cover at least a quarter of the entire millet production area in the Kaolack region, far in excess of the area currently covered by composting. Added to this uncontested supply is the annual volume of retired millet stalk fencing around compounds and livestock pens.¹⁸

- **Availability of labor and lack of equipment:** Composting is, more often than not, associated with a proportionally heavy demand on labor which is otherwise in short supply. Once the compost pit has been constructed, however, the labor requirements are not prohibitive if the composting occurs only during the rainy season (as discussed above). This would reduce the labor needed for watering to nearly zero. Moreover, if sufficient attention were given to provide credit for the farmers to procure essential equipment for composting (including a charette), then the labor requirements would be reduced yet further. The charette and other equipment would also be labor-saving devices in other regular farming operations. The availability of equipment (or lack thereof) is included as a variable in the analytical framework developed for this study, based partly on standard cost estimates for different technologies provided by CBNRM.
- **Lack of financial means:** This is perhaps the most quoted constraint – farmers do not have the financial means with which to invest in the construction of cement pits; hence, those who practice composting will do so above-ground, or in unlined clay pits. Understandably, farmers cannot invest in anything that requires cash if the cash is not available. It seems that only NRM technologies requiring labor investments harbor reasonably good prospects for increased adoption over time.

The need for cash for investments, however, should not at all deter the consideration of technologies requiring cash investments. Promoting only the labor investment technologies could mean foregoing the best technologies – those most often associated with superior rates of return. In this context, there has been much discussion about the kinds of compost pits to promote and many experts (if not most) disagree for good reasons. ISRA/Bambey argues strongly for the cement compost pits because the quality of the above-ground compost is claimed to be far inferior to compost produced in the cement pits. The latter retain the nutrients, the former much less so. Others argue vehemently for composting schemes that do not require up-front cash investments. In this study, the latter is tested – the economics of compost pits dug in clay soils only (no cement), since this reflects what farmers would probably implement given realistic field circumstances in the present. Cement pits are currently built and in use, but only if heavily subsidized. If, however, it

¹⁷ It is estimated (interview with CBNRM) that, in order to fill one small compost pit (four m³ capacity) will require approximately 12 charettes of millet stalks, or roughly two tons of biomass, plus 800 to 1000 kilos of manure. The finished compost will be sufficient to cover 1/4 hectare at a rate of two tons per hectare.

¹⁸ This, of course, will only be possible if the other constraint–manure–is composted with the millet stalks (and other biomass, including household organic waste) instead of applying it directly onto the fields, as is currently the most commonplace practice.

becomes increasingly obvious and well documented over time that the cement pits outperform the above-the-ground or clay pits in economic terms, then the focus of the extension message should be changed and the availability of credit to allow farmers to invest facilitated.

1.1.2 Live Fences

Live fences are promoted as a means to replace dead fences in the farm landscape and to add to the vegetative cover in the target areas. Dead fences (usually involving the collection and piling of thorny branches around small farm fields in need of protection against livestock intrusion) are: a) time consuming to build, b) environmentally destructive as the fences must occasionally be replaced (thorny biomass is collected from elsewhere), and c) provide no other benefit than protection. Live fences, on the other hand, are: a) environmentally friendly since they add to the vegetative cover in the area rather than reduce it, b) once installed, they need not be replaced, and c) they provide benefits in addition to protection against livestock intrusion in the forms of fuelwood, polewood, and other products, depending on the species used. Farmers will typically fence areas to protect cash crops such as manioc and others, and/or around gardening plots.

As stated in the Limited Assessment report (1998) the adoption of live fences is not generally constrained by lack of knowledge. It generally indicates a desire to intensify production on the fenced parcel and is, therefore, often accompanied by other NRM investments such as manioc production, tree planting, or irrigation schemes. The economics of live fences is documented to some extent in Satin (1998) and Karch (1991). Both carried out financial analyses of live fences and found them to be eminently feasible from the farmers' perspectives. Both used a partial budget approach by determining the incremental increases to a farmer's workload by adding the live fences to the current farming system, thus adding the additional inputs needed to include the practice.

In his analysis, Satin (1998) counted the increased revenues from the live fences only, not what is grown inside. The sources of revenues, therefore, included the wood products (fuelwood and poles mostly) and fruits and other products which can be sold in local markets. Karch (1991) reported internal rates of return (IRR) in excess of 80 percent from the live fences, and more than 50,000 FCFA NPV per hectare, accounting for the increased benefits (wood and other products) harvestable from the fences themselves, plus the benefits from increased crop values inside the enclosures. In summary, both authors found the live fence intervention to be comfortably feasible from the perspective of individual participating farmers.

A major weakness of both analyses was the failure to explicitly list and discuss the key assumptions – the live fence configurations (size of the average enclosures) are not known, nor what the live fences are intended to protect. It is, for example, not usual for farmers to enclose millet or peanut fields, as was assumed by Karch. A more common practice is to enclose fields for the purpose of growing new cash crops, such as manioc – fields often associated with relatively low opportunity costs – or ill suited for millet and/or peanut production. The major land use foregone, therefore, may be grazing.

1.1.3 Field Trees

Field trees, particularly the Kad (*Faidherbia albida*), are widely promoted by donors, NGOs and ISRA alike. Sufficient presence of these trees in the farm landscape substantially increases crop yields, hence

their planting and protection from livestock trampling (and consumption) during the establishment period is strongly encouraged. Farmers, on the other hand, may be reluctant to do so because: a) they can ill afford to give up any cultivable space to trees, b) the financial means to procure protection devices or know-how to build them (if protection devices are needed) may be lacking, and/or c) labor may be in short supply. Moreover, farmers were advised, in the not so distant past, that field trees should be removed to make way for plows, chemical fertilizers, and peanut production (Christophersen et al, 1998). Today, efforts to reverse this unfortunate advice are underway. The IRR for the investment in field trees investment was found by Karch (1991) to be 115 percent, financially very attractive from the farmer's perspective, indeed. The benefits counted included increased crop yield and sale of pods and leaves, measured against minimal protection costs (i.e., protecting the young trees with thorn bushes instead of iron baskets). The major weakness of the study is in its failure to provide any detailed specification of assumptions in the report, nor any mention of the current incidence of field trees in the farm landscape vs the optimal incidence.

1.1.4 Woodlots

Revegetation of the farm landscape with woodlots is an option often exercised by farmers in many countries, Senegal included to some extent, when the economics tree production outperforms the economics of food production and/or reduces risk due to diversification of the farming system¹⁹. Determining the economic feasibility between different land use options and informing the farmers about the results through woodlot demonstrations is essential. Promoting woodlots should not be done solely on the basis of the environmental and ecological benefits – the economic attractiveness of producing trees should be in the forefront of the extension approach. Karch (1991) found block plantations of *Eucalyptus camaldulensis* to be eminently financially feasible from farmer's perspective (IRR 32 percent), although they did not rank high relative to other interventions such as the protection of field trees, live fences and windbreaks, and fruit trees, and others (no. 8 out of 9 interventions analyzed). CBNRM has also recently carried out (1998) some simple financial feasibility tests for woodlots based on classical forestry principles (4 x 4 meter spacing including thinning regimes and harvesting at the optimal biological rotation age when the mean annual incremental growth is maximized), finding them to be financially feasible from the farmers' perspectives.

1.1.5 Rock Dikes

Heavy erosion is a major limiting factor to food production in Senegal – the inability of tired soils to retain moisture. Millet, sorghum, and millet fields are, more often than not, characterized by expansive areas with some slope prone to heavy water runoff. Unless these areas are subjected to water conservation measures, they will gradually erode away to the point where their restoration will be too costly and the land must be abandoned. Rock dikes strategically placed along the contours in the farm fields is a relatively simple NRM

¹⁹ If the resources are available, woodlots reduce risk, provide an additional source of revenue for people in or near retirement, and perhaps a long-term claim to a piece of land.

technique that can have a significant impact on crop yields, particularly in areas with low rainfall (300 to 500 mm per year). In these areas, every drop of rain counts – it is essential that the runoff be slowed to allow the water enough time to filter into the soils. The small amount of additional moisture at critical periods in plant development provided by the technique can have a dramatic impact on crop yields. Note also, however, that barriers of trees, shrubs, or grass planted in the same manner can have a similar impact, and is particularly useful in those areas where rocks are not readily available.

Little evidence on the economics of rock dikes appears to be available, at least for Senegal. Christophersen et al (1988) documented up to a 50-percent increase in crop yields in Mali following the installation of rock dikes and gully plugs to stem the water runoff, and a positive rate of return. The latter, of course, depends on the availability of nearby rocks and the relative ease with which they can be mined. Building rock dikes is back-breaking work and the economics should be well documented before the technology is heavily promoted.

1.1.6 Improved Cookstoves

Adoption of improved cookstoves contributes significantly to broader NRM goals. It is highly gender specific and decreases women's workload, saving time that can be used for other activities of production. The improved stoves component is analyzed differently than the other NRM technologies – more from the perspective of the amount of wood and time saved and less from the economic or financial perspectives. Since only clay stoves are considered for purposes of the analysis, there is no potential for the development of any private enterprise to build and sell stoves, hence no financial feasibility to consider from the perspectives of those who build them. They are not sold – people are, instead, trained in how to build and operate them. Villagers who have received training tend to adopt the stoves because the advantages are obvious. Those who have not received the training tend to still use the highly inefficient three-stone stoves. Clearly, the use of improved woodstoves that save fuelwood should be prioritized. The limiting factor, however, is the availability of trainers to work full time in villages training people in how to build and maintain the improved stoves. One specialist can train dozens of women in a training-of-trainers program in only a few weeks. In turn, the trained women can train others and the technique will spread. Many women in KAED, Winrock, and Rodale villages are probably already well equipped with the necessary knowledge to function as trainers for other neighboring villages.

Of particular economic significance in this woodstoves component of the study is to demonstrate the obvious advantages of saving fuelwood rather than producing it. Consider the following example: if the improved stove saves 30 percent, 100,000 m³ of wood will generate 21,000 tons of fuelwood saved (assuming one solid m³ of fuelwood weighs 700 kg – $100,000 \text{ m}^3 \times 700 \text{ kg} \times 30 \text{ percent} = 21,000 \text{ tons}$), assuming that all of the wood is burned in the improved stoves. One hectare of planted eucalyptus typically produces 25 m³ of wood every five years (or growing at a rate of five m³/ha per year), of which, say 25 percent is fuelwood (the largest portion of the volume will be sold as poles which typically fetch higher market prices). Only 6.25 m³, therefore, will be used/sold as fuelwood, or a total of 4,375 kg dry weight (approximately 4.4 tons per hectare). Since this volume will be available only once every five years, an

annual volume of this magnitude (the 4.4 tons) will require a total of five hectares planted one year apart. To produce 21,000 tons of fuelwood per year (equal to the saving from the 100,000 m³), therefore, 4,800 hectares must be planted every year for five years (or a total of 24,000 hectares). It is obvious that improved stoves are far more cost-effective, particularly in view of the fact that stoves will generate savings right away – there is no 5-year waiting period.

Producing the 100,000 m³ of wood in plantations over an area of 24,000 hectares would certainly be a major undertaking, and indeed a desired one if it were also financially feasible to do. However, 24,000 hectares is a large area for which competitive land uses are certain, many probably associated with higher and better economic uses (perhaps the production of manioc, or other cash crops). It would be far easier to avoid the land use competitiveness and other constraints to wood production by saving the wood through the use of the improved stoves instead.

A note of caution is in order, however. The potential wood savings obtained in laboratories will typically be far greater than in reality, as demonstrated in **Section 3** below. The lower saving is attributable to two major factors: a) the stoves are not used properly; i.e., they save less in actual use than laboratory conditions claim, and b) only a fraction of the wood collected is actually burned in the improved stoves. The 3-stone stove located next to the improved stove may be just as busy because the latter cannot accommodate all of the cooking needed during holidays and special feasts. Moreover, a fair percentage of the wood may be burned in open fires for heat during the cold season, and to provide lighting. The actual savings generated under realistic field conditions, therefore, are usually far lower than the potential savings the improved stove proponents claim.

1.2 The Analytical Approach

The analytical approach is simple – to confirm or reject the financial feasibility of several NRM technologies supported by USAID over the years from the farmers' perspectives, as published in the reports cited above. This is followed by aggregation scenarios reflecting the KAP adoption rates to determine what the investments bought – the economic returns – and physical outputs.

The sluggish rate of adoption of the different technologies over time can probably, at least, be partially explained by: a) the absence of any overt focus on the financial attractiveness of the technologies from the farmers' perspectives (or alternatively, the lack of financial attractiveness dissuades farmers), and b) donors (USAID included) have established a precedent of subsidizing farmers to adopt the practices making adoption more a function of the subsidies rather than the merits of the technologies themselves. Why should farmers adopt something on their own if donors are ready and willing to pay them to do so? Subsistence level farmers tend to be risk averse and will typically opt for technologies with which they are familiar, even though they only produce enough to just feed the families with little or no surplus to sell on the local markets. There is currently little appreciation for the fundamental economic principle of shifting factors of production (land, labor and capital) into the most economically efficient production schemes unless and until

the basic subsistence needs are met. In short, this mode of operation describes “local field realities” within which donor assistance tends to confine itself – extending technical assistance and other support only within the context of the observed field constraints. A case in point is cement pit composting as opposed to above-the ground composting as discussed above. The adoption of the former without subsidies has been near zero because of the fact that the cement pits require cash investments which the farmers can ill afford, despite the fact that the quality of the compost produced in the cement pits is far above the above-the-ground compost. If the economic attractiveness of the cement pits is demonstrated to be higher than the alternatives, farmers would, by definition, be better off with the more expensive alternative and donors should not abandon it. The differences in the financial attractiveness between the two alternatives should eventually be clearly demonstrated and be made an integral part of the extension message.

1.2.1 Population and Areas

Table 1.1 shows the regions included in the analytical framework developed for this study – Fatick and Kaolack regions – both are part of the SO2 zone surveyed in the KAPs. These regions of relatively reliable rainfall have been considered USAID target areas for many years having received support through activities such as KAED, OFPEP, NRBAR, PVO/NGO Support, and CBNRM²⁰. The table also summarizes the information relevant to the analyses with respect to area, population, population growth, and millet production. As indicated, Kaolack is the most populous region. Both are associated with a fairly high rate of population growth – three percent. This rate means that the burden on the improved NRM technologies to increase production to offset the impact of the population growth is quite substantial. For purposes of the analysis, only the millet/sorghum area is considered eligible for improved NRM techniques (the staple crops) to be consistent with the need to address food security before promoting other technologies. The total area in these crops, therefore, comprises the upper limit to the aggregation schemes developed and analyzed later in this report. The higher the targets, the more one presumably could accomplish with respect to food security, particularly when accounting for the long run impact of population growth on food security.

Table 1.1: Population and Area

Population and area	Fatick	Kaolack
Population	684997	1090263
Population growth per year	3.0%	3.0%
Total area (hectares)	793500	1601000
Area devoted to millet/sorghum production (hectares)	139000	332500
Current millet production per year (tons)	87600	267700

Sources: Bucknall et al, 1997

²⁰ The other two regions in the SO2 KAP survey – Kolda and Tambacounda – were not included in the analytical framework for lack of time and budget. The results presented for the Fatick and Kaolack regions are indicative for the excluded regions also, however; i.e., if the interventions tested are feasible in Kaolack and Fatick, they will likely be feasible in Kolda and Tambacounda as well.

1.2.2 Perspectives

The analytical approach taken is, first and foremost, to determine the feasibility of the NRM technologies from the perspective of the intended beneficiaries – the local farming communities who largely operate under subsistence level conditions. It is essential to first demonstrate that all field activities are financially strong from the perspective of the participants before continuing to promote them on a large scale. If not feasible, local participation will not be forthcoming as evidenced in the KAPs by the fairly sluggish rates of adoption for certain technologies, even when subsidized. All of the results are expressed in terms of net present values (NPV) and/or internal rates of return (IRR) on a per hectare basis.

Once having determined the farmer-perspective financial feasibility of the improved techniques on a per hectare basis, the next step is to retain the most promising ones and reject others that are obviously not competitive (based not only on the financial and economic criteria, but on cultural, social, and technological criteria as well). The retained interventions are then aggregated in accordance with targets to provide estimates of the possible aggregate impact. The aggregate analysis is also the economic analysis carried out from the perspective of the GOS. It consists of: a) using shadow prices for key variables such as the discount rate²¹, and b) multiplying the net cash flows (NCF) of the per hectare analysis by the number of hectares targeted in each region using field interventions in accordance with development targets derived from the investment packages (for which financial feasibility will have been determined).

1.2.3 Elements of the Analytical Model

The analytical model was developed on Lotus 123 which is easily converted to Microsoft Excel. It contains separate templates on the interventions briefly discussed above for analysis on both a per hectare basis and in the aggregate. The input and output templates are kept separate for ease of operation. All results are expressed in NPV and IRR terms, both for the per hectare and aggregate analyses.

1.2.4 Limitations

There are, of course, several limitations to the analyses presented in this report:

- **First**, only a small fraction of the improved technologies have been subjected to financial and economic analysis – all should be similarly analyzed as a matter of formal routine among activity implementors. The Knowledge, Attitudes and Practices (KAP) survey carried for 1998 is tracking some 15 leading indicators (NRM techniques) and six supporting indicators. Only six NRM techniques are analyzed in this study.

²¹ See discussion on shadow prices in **Section 4** below – only the discount rate is shadow priced for purposes of the analysis.

- **Second**, as with any analytical framework, the model developed for purposes of this analysis cannot capture all field realities, particularly with respect to the price, cost, and productivity projections over time. For example, the marketability of the increased production of crops and/or wood needs to be confirmed – it is assumed that ready-made markets exist for any increases in production as a result of USAID’s support of field interventions.
- **Third**, the study does not include estimates of price and income elasticities for the commodities produced because the demands for the crops and/or commodities analyzed were not estimated in detail.
- **Fourth** and finally, the analyses and corresponding results reflect interventions that are based on certain technical configurations and levels of management intensity that may be different from those actually promoted by and implemented with USAID support. Technical variants of the same kinds of interventions will generate different financial results, but not necessarily enough to warrant re-analyses in every case.

The purpose of the analysis is threefold: a) to revisit whatever little has been done on the economics front to confirm and/or reject the conclusions stated in this work as to the feasibility of the interventions promoted, b) if feasible from the perspective of the intended beneficiaries, to speculate on why the interventions have not been adopted on a larger scale, and c) instill vigor in promoting interventions on the basis of their economic attractiveness through CBNRM and other USAID activities.

2.0 Financial Analysis Assumptions

2.1 Introduction

The section provides a detailed listing and brief discussions of all the assumptions used in the analysis. The assumptions are documented to the extent possible, although some are only estimated based on responses obtained in field interviews. Several assumptions are based on field interviews conducted during the Limited Assessment effort in January 1998 and during the current mission. Some variables are intentionally not documented but instead used for calibrating purposes; i.e., activated to find feasibility breakeven points in benefits and/or costs. The extent of subsidies needed in order to reach financial feasibility from the perspective of the participant farmers, and the opportunity cost of land, are two examples. The subsidy variable is closely related to the CBNRM Activity where matching grants form an integral part of the approach to adoption of the improved NRM technologies. Once a proposed field activity has been approved by the NRM committees for an area, the level of cost matching is negotiated with the intended beneficiaries – how much the project will contribute to defray the costs of the field activities. The matching of costs is done regardless of whether the proposed interventions are financially feasible on their own merit.

Most of the assumptions used in the financial analysis are anchored to specific NRM technologies with respect to inputs and outputs and management intensity. Any change in the assumptions will generate different results. Included are assumptions on the financial discount rate, real cost and price appreciation rates, prices, costs, and yield responses to implementing the technologies and technology specific assumptions.

2.2 Generic Assumptions

Following are brief discussions on several assumptions generically applicable to all of the techniques analyzed.

2.2.1 Analytical Time Horizon

The analytical time horizon assumed for all of the interventions (except the improved stoves) is 15 years. This accommodates all forestry interventions (woodlots, field trees, live fences) for which the time period between the investments and realization of the benefits is relatively long. The 15-year analytical time period is also sufficiently long for the other interventions as well.

2.2.2 Discount Rate, Cost and Price Appreciation Rates

The economic assumptions relating to the discount rate and the extent to which prices and costs are likely to change (increase and/or decrease in real terms in the future) are summarized in **Tables 2.1 - 2.3**. **Table 2.1** shows the assumptions used, **Tables 2.2** and **2.3** show how they were derived. A high real financial discount rate of 30 percent is assumed, more than three times the documented real rate of interest prevailing in the Senegalese economy with respect to lending from the agricultural credit institutions (see **Table 2.2**). This high rate is assumed in order to capture, or offset, the very important risk factor inherent among subsistence level farmers – the proposed technologies must clearly demonstrate that the intended beneficiaries will be financially much better off with them than without them, particularly if the time period between making the investments and reaping the rewards is long. As stated by French (1979): "For an impoverished villager, a year from now is very far away. Consciousness must be focused on a present in which the margins for survival are extremely narrow." The implicit discount rate that a peasant places on making changes is therefore typically very high.

Table 2.1: Discount Rate, Price and Cost Appreciation Rates

Assumptions	Farmer Perspective (Financial)
Discount rate	30 percent
Price appreciation rate	0 percent
Cost appreciation rate	0 percent

Table 2.2: Derivation of the Discount Rate

Year	Consumer Price Index	Annual Change (%)	Bank Lending Rate (%)
1987	100		15.00%
1988	101.9	1.90%	15.00%
1989	101.6	-0.29%	15.00%
1990	102.4	0.79%	15.00%
1991	103.7	1.27%	15.00%
1992	104.7	0.96%	15.00%
1993	107.9	3.06%	15.00%
1994	146.9	36.14%	15.00%
1995	164.4	11.91%	15.00%
1996	176.2	7.18%	15.00%
1997	182.2	3.41%	15.00%
1998	177.5	-2.58%	15.00%
Average		5.80%	15.00%
Real rate			8.70%

Source: Ministère de Finance, Direction Statistique

The choice of the 30-percent farmer-perspective discount rate is based to some extent on the information given in **Table 2.2** showing the behavior of the general consumer price index in Senegal for over the last 12 years (1987 - 1998). The average rate of inflation has been less than six percent per year. Over the

same time period, the average lending rate at Centre National du Credit Agricole Sénégal (CNCAS) has been roughly 15 percent for non-guaranteed short-term loans (up to one year)²². The calculated real rate of interest applicable to the agricultural sector is, therefore, in the neighborhood of 8.7 percent:

$$((1 + 0.15) / (1 + 0.058) - 1) \times 100 = 8.7 \text{ percent.}$$

For purposes of the base case analysis, a discount rate more than three times the documented real rate is assumed in order to capture all of the real and perceived risks involved. If the proposed interventions are still financially feasible given this assumption, one can be reasonable certain that the intended beneficiaries will be substantially better off with the interventions than without them.

The background justification for assuming the zero appreciation rates for costs and prices is presented in **Table 2.3**. Applying the same general consumer price index as in **Table 2.2** to agricultural prices, and a labor cost index to compute the real changes in labor costs, one concludes that real prices and costs have declined somewhat over the 1987 - 98 time period (labor costs at a slightly steeper rate). For purposes of the analysis, however, both are assumed to remain at zero percent for the analytical time period – the difference in the rates of decline over time between the two variables does not warrant any greater precision in the assumptions.²³

Table 2.3: Derivation of Real Price and Cost Appreciation Rates

Year	Consumer Price Index	Ag. Sector Price Index	Real Ag. Sector Price Index	% Change Ag. Price Index	Labor Cost Index	Real Lab. Cost Index	% Change Lab. Cost Index
1987	100	100	100.00		100	100.00	
1988	101.9	100.5	98.63	-1.37%	100	98.14	-1.86%
1989	101.6	103	101.38	2.79%	100.8	99.21	1.10%
1990	102.4	93	90.82	-10.41%	101.2	98.83	-0.39%
1991	103.7	94.1	90.74	-0.09%	100.8	97.20	-1.64%
1992	104.7	98.6	94.17	3.78%	100.8	96.28	-0.96%
1993	107.9	100.1	92.77	-1.49%	101.5	94.07	-2.29%
1994	146.9	116.8	79.51	-14.29%	106.3	72.36	-23.08%
1995	164.4	133.2	81.02	1.90%	113.2	68.86	-4.84%
1996	176.2	141.2	80.14	-1.09%	108.9	61.80	-10.24%
1997	182.2	136.7	75.03	-6.38%	109	59.82	-3.20%
1998	177.5	154.8	87.21	16.24%	114.9	64.73	8.20%

²² The variations of the lending rate could not be adequately documented by the team (for lack of sufficient time). The current rate has remained fairly constant, however. **Table 2.2** is included only for the purpose of illustrating the process of deriving a farmer-perspective discount rate certain to capture all of the risks involved.

²³ Any difference between these variables will cause a growing divergence between costs and benefits over time, hence the impact on the NPV results may be substantial. If real costs increase faster than real prices, for example, the NPVs would be lower.

Average	-0.95%	-3.56%
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Sources: Ministère de Finance, Direction Statistique

2.2.3 Crops, Yields, Labor Costs, and Price Assumptions

Most of the NRM technologies analyzed (composting, live fences, rock dikes, and field trees) will have an impact on major staple crops grown in the target areas. For purposes of the analysis, the following assumptions are made: a) the crops linked to the analysis are **millet** in the case of composting, rock dikes and field trees, and **manioc** in the case of live fences, b) **Eucalyptus** trees and associated stumpage prices for fuelwood and poles for the woodlot intervention, and c) **clay stoves** only for the improved stoves intervention. The assumptions concerning the crops, yields, labor costs, and prices are summarized in **Table 2.4** below.

Table 2.4: Crops, Yields, Labor Costs, and Price Assumptions

Variables	Fatick	Kaolack
Millet yield per hectare (without interventions), kg per hectare	400	500
Average millet consumption, kg per capita per day	0.66	0.66
Farm gate price for millet per kilo	100	100
Farm gate price for manioc, FCFA per kilo	60	60
Farm gate price for manioc leaves, FCFA per kilo	0	0
Average opportunity cost of time (FCFA/day)	800	800
Average stumpage price for fuelwood, FCA per m3	6000	6000
Average stumpage price for poles, FCFA per m3	28000	28000

Sources: a) Bucknall et al 1997, b) Faye 1998, c) interviews with ISRA/Bambey researchers (notably Dr. Ibrahim Diaité), and d) Karch 1991

- Millet yields and consumption:** The calculated millet yields in the two regions are 630 and 805 kilos per hectare, respectively (**Table 1.1**); i.e., the current millet production divided by the area. For purposes of the analysis, however, lower initial yields of 400 and 500 kilos for the two regions are assumed to account for the millet yield portion only, not the sorghum or peanut yields harvested on a rotational basis on the land devoted to millet/sorghum production (**Table 1.1**). It is noted, of course, that crop yields will vary considerably within each region as well as between regions – the purpose here is only to state the initial base case assumptions on which to base the analysis. It is also important to note that millet yields vary significantly between different sources. The crop production data from IFPRI/ISRA, for example, indicates that the average yield per hectare in 1989-90 was 503 kg, higher than the yields assumed here. Note, however, that the magnitudes of the initial yields are far less important than potential for increasing yields in with the application of the improved techniques. The average daily consumption of millet per capita is estimated at 0.66 kg (Faye 1998).

- **Farm gate prices for millet and manioc:** Millet is the major staple crop assumed to be most affected by the proposed improved NRM technologies²⁴. Several pricing scenarios are possible: a) just before harvest when prices are highest because supply is at the lowest point, b) the average price during the middle of the dry season, and c) at harvest time when prices are lowest because supply is at its highest level during the season. For purposes of the analysis, the base case assumption is the lowest price during the season; i.e., at harvest time. For millet, this price is assumed to be 100 FCFA per kilo, and for manioc, 60 FCFA per kilo. These prices will be varied in the sensitivity analysis. Also included in the analytical framework is provision for the production and sale of manioc leaves. The edible leaves have vigorous markets in some areas, but not in others. For purposes of the base case analysis, however, the leaves are assumed to have no value for lack of information in many areas about market opportunities, although the provision is made in the analytical framework to count the production and sale of manioc leaves as a benefit.
- **Labor costs (opportunity cost of time):** A realistic labor cost assumption is difficult to estimate because local farmers will not be salaried workers for a project. Participants will, instead, be asked to invest their time (and cash) to work on the recommended NRM technologies. For example, farmers participating in a live fence scheme will spend time preparing the site, procuring the seedlings needed, planting, and maintaining the site once established. Since there are no salaries involved, the time investments made by the farmers are measured by the opportunity costs – the incomes they *would have* earned elsewhere had they not worked on the interventions. For example, farmers could be occupied with cutting and selling fuelwood where the value of time would be based on how much they could cut and prepare for sale per day given the price they would be paid by the wood entrepreneurs. How much farmers could earn elsewhere is commonly referred to as the opportunity cost of time, estimated for two regions to be 800 FCFA per day. This is higher than the 500 FCFA assumed by Karch in 1991 to account for the devaluation of the FCFA that occurred in 1994, after the completion of that study.
- **Stumpage prices, fuelwood and poles:** For purposes of the analysis, a stumpage price of 8,000 FCFA per solid m³ for fuelwood is assumed for the base case. This is based on: a) the assumed market price for fuelwood in major urban areas of some 35 FCFA per kilo²⁵, b) a weight of 700 kilos of fuelwood per solid m³ (assuming fairly straight pieces of wood that will

²⁴ It is recognized, of course, that farmers produce different crops (millet, peanuts, and sorghum) in rotational schemes. For the sake of analytical simplicity, however, only millet is included since the feasibility of the interventions would not be significantly different from the feasibility of the same interventions applied to different rotational schemes. For more detailed feasibility analyses, however, the analytical framework developed for this study should be expanded to accommodate other rotational schemes as well.

²⁵ The average retail price will typically vary widely depending on season and city. The assumption made is intended to reflect and average for purposes of the base case analysis.

pack tightly), and c) 1/3rd of the retail market price reflects the value of the fuelwood on the stump, before it is cut²⁶ (estimates are based on field interviews). The stumpage price for poles is derived similarly: a) each tree contains one pole at between four and five meters long with an average diameter of seven cm, b) each pole fetches 1,500 FCFA roadside (reasonably near major urban markets), c) one solid m³ contains approximately 55 poles, and d) ½ of the retail market price reflects the value of the poles on the stump, before it is cut.²⁷

2.3 Composting

Research (Badiane 1996) has clearly shown that simple composting of millet fields in the Departements of Diourbel (Diakael Dig) and Bambey (Ndiakane) will typically generate a yield increase of 22 percent with composting following traditional “paysanne” practices (NRBAR/ISRA multi-year trials show no significant difference between applications of two tons and four tons per hectare, and therefore recommends two tons). Aminata Faye (1998) tested more sophisticated techniques for NRBAR in the Fatick region using cement pits: a) composting only (with only two tons per hectare), b) composting plus natural phosphates, and c) composting plus natural phosphates plus improved millet seeds, and found that crop yields increased by 42, 94 and 141 percent for the three technologies, respectively. She also estimated the financial rate of return on investment to be as high as 330 percent from the farmers’ perspective²⁸. Similar results were obtained by Ndoeye (1998). The major weakness with both of these efforts, however, was that neither used discounting of future benefits and costs. The feasibility of the intervention was determined on the basis of a straight comparison of costs and benefits without accounting for the time factor. Nor did they account for the labor input (the assumed opportunity cost of time is zero).

The assumptions pertaining to composting are summarized in **Tables 2.5 - 2.7** below. The base case assumptions are linked to the least expensive form of composting, using unlined clay pits or above-the-ground composting and no additional physical inputs – the kind of composting technology farmers are most likely to adopt because they involve few cash investments. Cement pit composting can easily be tested by adding the pit physical input construction costs (i.e., the cost of the cement and corresponding labor). Three technical alternatives are listed in **Table 2.5** indicating a progressive increase in the mix of inputs: alternative 1, composting only, alternative 2, composting plus application of natural phosphates, and

²⁶ $35 \text{ FCFA} \times 700 \text{ kg} \times 33\% = 8,085 \text{ FCFA/m}^3$

²⁷ $1,500 \text{ FCFA} \times 55 \text{ poles} \times 50\% = 41,250 \text{ FCFA/m}^3$. Only 50 percent of the market value is used here as a proxy for the stumpage price because the labor required to convert the tree to poles is less than cutting the trees into much smaller pieces for fuelwood.

²⁸ The main weakness of her study was the absence of any time discounting. If an appropriate (high) farmer-perspective discount rate were applied, the real rate of return would decline substantially, yet still very attractive as demonstrated below in this report, even without any financial incentives.

alternative 3, composting plus natural phosphates plus improved millet seeds. Results for all three will be presented. in **Section 3**.

Table 2.5: Technical Alternatives, Composting

ALTERNATIVES	Fatick	Kaolack	Thies
Alternative 1: compost only (1 = yes, 0 = no)	1	1	1
Alternative 2: compost + natural phosphates (1 = yes, 0 = no)	0	0	0
Alternative 3: compost + natural phosphates + improved seeds (1 = yes, 0 = no)	0	0	0

There is one major caveat with the third alternative, namely the very real constraint of the absence of a ready supply of improved millet seeds (Souma 3) and chemical fertilizers. The lack of improved seeds is the biggest problem with respect to composting, by far. As stated in the Limited Assessment report (1998), only a small supply of improved seeds is currently available for research purposes through ISRA/Bambey. Farmers in the aggregate, therefore, do not have unlimited access to improved seeds as would be needed for large scale adoption. Unless this very important constraint is resolved, the obviously most feasible version of composting becomes inaccessible for most farmers. One could continue to promote composting without the other inputs because this would certainly constitute a biological improvement over no composting – crop yields would increase indeed, and progress would be made towards self-sufficiency in millet production. It would contribute far less to food self sufficiency, however.

2.3.1 Costs

The cost assumptions are summarized in **Table 2.6**.

- **Construction costs:** First, the assumed configuration of the pit is 4 x 4 x 1.2 meter (length x width x depth) – a size sufficient to contain a volume of approximately 15 m³ of compost when full. One such pit will produce enough compost to cover at least one full hectare with approximately two tons of compost²⁹. For the base case clay compost pit, five days of manual labor to dig the pit is estimated. No physical materials inputs are required.
- **Biomass inputs:** The biomass input consists largely of millet stalks, other crop residues, and manure, adding up to a total biomass weight input of approximately eight tons. For purposes of the base case analysis, *this biomass volume is valued at an opportunity cost of 0 FCFA per kilo because the biomass used for composting is the leftover uncontested residues from last years harvest*, as discussed in **Section 1** above. Analyses of this and the other technical alternatives will invoke different biomass opportunity cost scenarios to test the extent to which the biomass value has an impact on the financial feasibility of the intervention.

²⁹ There are many different sizes of compost pits used throughout the two regions. The configuration assumed here is calibrated to accommodate one hectare with two tons of compost.

- **Watering and mixing and emptying the compost pit:** If the composting occurred during the rainy season (which is recommended), the need for watering would be considerably reduced. It is assumed for the base case, however, that some watering and mixing labor will be needed – a total of three person days per compost load. Emptying the pit and spreading it is assumed to require another three person days, assuming also that a charette is available or is rented.

Table 2.6: Composting, Costs

COSTS (INPUTS)			Fatick	Kaolack
Pit, configuration (L 3 m, W 3 m, D 1.2 m), physical input costs (FCFA)			0	0
Construction costs, man days			3	3
Construction takes place in year	1	Labor cost, FCFA per day	800	800
Biomass input weight (kg)			8000	8000
Estimated opp. cost for biomass (millet stalks + manure)/compost pit, FCFA/kilo			0	0
Watering and mixing (person days/compost load)			3	3
% crop yield decline over time, no composting scenario			0.0%	0.0%
Emptying the compost pit (man days per compost load)			3	3
Equip. level available for composting, expressed as function of need (%)			80%	80%
Procure additional equipment, year	1	Cost/equip. unit (at 100%)	17500	17500
Level of subsidy needed			0.0%	0.0%

Sources: a) Faye 1998, b) Ndoye 1998, and c) CBNRM standard cost estimates

- **Equipment:** CBNRM has estimated the equipment needed to ensure that the compost pit could be constructed and maintained. Included among the equipment requirements: shovel, pick, pitch fork, watering can, and rake. The procurement of these items would amount to approximately 17,500 FCFA. It is assumed that the participating household already own 80 percent of the equipment needed, hence, only 20 percent must be procured.
- **Level of subsidy needed:** A subsidy rate of zero percent was assumed in the base case; i.e., the analysis was carried out as if no subsidies of any kind were available, other than technical assistance only.

2.3.2 Benefits

On the benefit side, the assumptions are summarized in **Table 2.7**. Only one quantifiable benefit is assumed, namely the extent to which crop yields increase as a result of applying compost at a rate of two tons per hectare. The documented rate of increase was obtained from experiments carried out in the Fatick region (Faye 1998). It was further assumed (based on field interviews) that millet yields in the Kaolack region would be higher by 10 percent relative to the documented yields obtained in Fatick. As shown in the table, applying compost only without the other inputs (phosphates and improved seeds) only a 42 percent increase will occur, whereas yields would increase by 141 percent if both phosphates and improved seeds were added, a significant increase, indeed. Recall from the discussion in **Section 1**, these yield increases were obtained from composting with the cement pits. It is assumed here that the clay pits will perform equally well.

An important variable was included in the analytical framework to reflect the extent to which crop yields decline over time if no new and improved NRM techniques (such as composting) were applied. Any increases in the crop yields as a result of applying the NRM techniques must be measured with reference

to this variable. For purposes of the analysis, a 2.5 percent crop yield decline over time is assumed (although conventional wisdom agrees this is realistic, it is not documented information).

Table 2.7: Composting, Benefits

BENEFITS (OUTPUTS)	Fatick	Kaolack
Millet yield increase, kg/ha, Alternative 1 (relative to no composting)	42%	46%
Millet yield increase, kg/ha, Alternative 1 (relative to no composting)	42%	46%
Millet yield increase, kg/ha, Alternative 2 (relative to no composting)	94%	103%
% crop yield decline over time (no composting scenario)	2.5%	2.5%

Sources: Adapted from a) Faye, 1998, and b) Ndoye, 1998

2.4 Live Fences

The basic premise for the live fence technology is the notion of protection – there is a need to protect certain crops or young tree seedlings against intruders, particularly against livestock eating or trampling the young plants if not protected. The conventional wisdom is that live fences add to the vegetative cover of an otherwise degraded area – certainly a positive development from a biological perspective. Financial and economic analysis of different live fence configurations will typically account for the costs of preparing the site for the perimeter fence, the cost of the seedlings, labor for planting and maintenance, the costs of clearing inside the perimeter and planting, and the opportunity cost of the land (as was done in this report as well). On the benefit side, the analyses will include the values extracted from the perimeter fence, if any, and the protected crops inside. If protection is the initial premise, it stands to reason that the least costly and workable live fence configuration should be preferred, all else being equal. In Senegal's 400-mm rainfall zone, this appears to be the *Euphorbia balsamifera* (salane) fence – the most common fence promoted throughout both regions because it is low cost, easy to install, and relatively effective against livestock intrusion when mature – it is a live fence, it protects, and the farmers adopt on a fairly large scale.

The salane fence, however, offers no benefits other than protection. The question that comes to mind is whether there are other financially attractive live fence configurations that could be considered, particularly in view of the fact the work to install the fence would be roughly the same in terms of time expended. The purpose of the analysis presented here is to sort out the economic differences between different live fence configurations to test if the protection only premise is a valid one. It may very well be that the values extracted from the perimeter fences exceed the values from the crops they intend to protect as will be demonstrated in the next section (or put more succinctly, the packaging is more valuable than the content of the box). If so, a wide range of new and different options become available for the farmers as discussed further below.

The assumptions for the live fence configurations are summarized in **Tables 2.8 - 2.10**. Three different technical alternatives are listed in **Table 2.8**: a) the salane fence alone; b) one temporary row of salane fence plus one row of *Acacia leatea* trees requiring purchased seedlings (this species is more effective

against livestock intrusion and adds considerable value by producing seeds that have a high market value); and c) one temporary row of salane fence plus two rows of *Acacia leatea*. The base case assumes the second alternatives – one row of salane fence intertwined with one row of *Acacia leatea*. In addition to the salane fence only, this configuration is often observed in the field as well. All three technical alternatives will be tested. Other excellent (thorny) species to consider include *Bauhinia rufescens* and *Acacia sénégale* (interview with Ibrahim Diaté, ISRA/Bambey).³⁰

Table 2.8: Technical Alternatives, Live Fences

ALTERNATIVES	Fatick	Kaolack
Alternative 1: 1 row of <i>Euphorbia balsamifera</i> (salane) fence (1 = yes, 0 = no)	0	0
Alternative 2: 1 row of <i>Euphorbia balsamifera</i> + 1 row of <i>Acacia leatea</i> (1 = yes, 0 = no)	1	1
Alternative 3: 1 row of <i>Euphorbia balsamifera</i> + 2 rows of <i>Acacia leatea</i> (1 = yes, 0 = no)	0	0

The major obstacle to adoption of the live fence NRM technology are (Badiane et al, 1996, interview with ISRA/Bambey researchers): a) they will occupy otherwise scarce cultivable space, b) conventional wisdom holds that dead fences must first be put in place and maintained for at least one year to protect the young seedlings during the critical establishment period – at least this is the extension advice most have been given; and c) lack of funds with which to invest.

On the first point, it is not a foregone conclusion that live fences will displace otherwise scarce cultivable space (Faye 1998). Rather, many farmers will enclose areas in bottom lands not currently suitable for millet production or other crops. These areas will typically be old garden plots where the water table has sunk to the point where continued gardening is not feasible. Yet, such areas would still be suitable for manioc production. The opportunity cost of such areas will be fairly low. Others, of course, will convert cultivable space to enclosed cash crop production schemes if they are well informed about the relative economic efficiency between the different possible land uses. In such cases, the opportunity cost of the land becomes an important cost factor.

On the second point, the dead fence argument carries little weight among ISRA researchers who claim that such temporary fences are not needed **if the timing for the installation of the live fences is carefully planned and executed**. They claim that if the fences are planted very early during the rainy season (between the time needed for preparing the millet fields and planting the millet) using seedlings already at least 25 cm tall. At this (planting) time plus four to five months into the rainy season the livestock is usually well controlled and the probability is low that trampling damages will occur. During the first six months after

³⁰ Winrock's has promoted salane live fences (under the auspices of USAID's OFPEP) to reintroduce and protect indigenous tree species inside the enclosures with the added assistance to farmers in growing cash crops inside the enclosures. The system has worked very well (described in the Ndollar case study in the Limited Assessment report – 1998). Farmers respond favorably to the proposed intervention, not necessarily because of the trees, but rather because of the added cash incomes received from the sale of manioc and cassava leaves. Winrock is currently investigating the economic attractiveness associated with species other than the salane fence.

fence establishment, therefore, the unprotected seedlings will develop strong root systems and grow to a height sufficient to offset most trampling or browsing damage occurring when the livestock is less controlled.³¹ For purposes of the analysis, however, it is assumed that a temporary dead fence or a row of salane to protect the thorny trees during the early years is still necessary, as confirmed by field observations. Farmers still feel that a newly installed live fence with thorny trees must be protected in the beginning by a dead fence or a salane fence. It is assumed, therefore, that one outer perimeter salane fence will be established with the acacias planted on the inside for alternatives 2 and 3. The avoidance of the temporary fences should be considered when the technique is firmly entrenched in the extension package and has been demonstrated to work successfully in the field.

On the third point – lack of financial means – this argument is always in the forefront as the most significant obstacle. Worse, donors have the tendency to abide by the reality of the argument and extend only those NRM technologies that comfortably fall within the means available to the intended beneficiaries. Salane fences, therefore, are often promoted because the seedlings (cuttings) are plentiful and often available at no direct cost, unlike seedlings produced in nurseries.³² This tendency, however, essentially robs the intended beneficiaries of the possibilities of earning much higher incomes from different fence configurations in exchange for small initial cash investments.

2.4.1 Costs

The cost assumptions are summarized in **Table 2.9**.

- **Configuration:** The configuration of the enclosure is important, a square enclosure will occupy more surface area than a rectangular one. If, for example, the enclosure is 50 by 50 meters (2,500 m²) and the tree seedling spacing is 0.50 m between the plants, a one-row fence will require approximately $50/0.50 \times 4 = 400$ seedlings. The same number of seedlings will be required for a rectangular fence, say 75 by 25 meters, however, the enclosed area would be reduced to only 1,875 m². This will have a substantial impact on the cost of the cuttings needed for the manioc production inside the enclosures.

³¹ Whether or not to protect the new fence during the critical start-up phase with a temporary salane fence or a dead fence is a critical issue. If required, then the costs will increase. If not, however (as indicated by ISRA/Bambey researchers), then the issue no longer costs, it becomes an extension problem – the extension workers will have to be diligent in ensuring that the installation of the fences is properly executed at the right time.

³² For purposes of the analysis, however, salane cuttings are assumed to have a cost if there is a market and they are obtained from neighbors who already have established salane fences. The cuttings are free if promoted under the auspices of a project such as OFPEP (Winrock), however, by obliging farmers who receive TA services today to provide free cuttings to new farmers entering the system next year, and so on.

- **Labor: site preparation, plant, replant and maintain – fence perimeter and inside enclosed area:** This information is difficult to obtain because the work is usually carried out in groups where some dig, others transport materials, some prepare meals, and yet others take care of children. Based on detailed questioning (during the Limited Assessment and the current missions) the preparation and planting of the fence perimeter (50 x 50 meters) taking all of these variables into account will require up to 30 full-time equivalent person days (eight hours per day) plus another 10 person days to prepare and plant inside the enclosed area. It is further assumed that approximately 15 percent of the seedlings will need to be replanted the second year. The maintenance of the fence perimeter (pruning and intertwining the branches) is assumed to require four person days per year.
- **Opportunity cost of land:** For purposes of the analysis, a 20,000 FCFA per hectare opportunity cost of land is assumed. This is considerably lower than the full value of land currently in millet, sorghum and/or peanut production, but higher than zero because the land where live fences are installed is usually not in staple crop production for reasons stated above. The opportunity cost probably reflects grazing values more so than land values based on the production of staple crops.
- **Inside the fence perimeter:** It is assumed that the main purpose of the live fence is to grow a cash crop inside the enclosed area, in this case – manioc. In order to plant manioc, ISRA/Bambey estimates that 5,000 FCFA worth of purchased manioc cuttings (one charette full) will be sufficient to cover the 1/4 hectare enclosed area. It is further assumed that the additional workload to plant and protect the crop during the growing season will require 15 full person days of labor (interview with ISRA/Bambey researchers).
- **Equipment:** As with the composting intervention, the establishment and maintenance of live fences will need some minimal equipment as well. For purposes of the analysis, equipment worth 10,000 FCFA (pick, shovel, and other equipment) will be needed (CBNRM equipment cost estimates), of which it is assumed that 80 percent is already available with the farmers (20 percent needs to be procured).
- **Subsidies:** Finally, it is assumed in the base case that no subsidies are available to promote the establishment of live fences.

Table 2.9: Live Fences, Costs

COSTS (INPUTS)		Fatick	Kaolack
Live fence established in year	1 Standard configuration (m in length)	200	200
Site prep. of fence perimeter, planting of seedlings, no. of person days		30	30
Seedling spacing for alternatives 2 and 3, distance between seedlings (m)		0.50	0.50
Replanting live fence in year	2 Mortality (%) to be replanted	15%	15%
Total seedling costs for perimeter delivered to planting site, alternative 1 (FCFA)		12000	12000
Average cost per seedling delivered to planting site, alternative 2 and 3 (FCFA)		150	150
Fence maintenance costs (pruning etc.), beginning year		4	4
Opportunity cost of land (millet production) inside the enclosure, FCFA		20000	5000
Site prep. inside perimeter in year	1 No. ha covered by one enclosure	0.25	0.25
Manioc cuttings needed for enclosed area, one charette full -- total cost in FCFA		5000	5000
Site preparation inside perimeter, and planting of manioc, no. of person days		10	10
Total labor needed to grow one enclosure full of manioc (no. of person days)		15	15
Equip. level available to plant/maintain fences, expressed as function of need (%)		80%	80%
Procurement of additi. equip., year	1 Cost/equip. unit (at 100%)	10000	10000
Level of subsidy needed		0.0%	0.0%

Sources: a) Field interviews with women's group, Ndiouffène, Thies region, b) Shaikh et al 1988, c) Karch 1991.

2.4.2 Benefits

The benefit assumptions are summarized in **Table 2.10**. In the analysis, the benefits are derived from both the perimeter fence (except the salane fence) and from the crops grown inside the enclosures.

- **Benefits from the perimeter fence (alternatives 2 and 3)**

A. Fuelwood and poles

For alternatives 2 and 3, once the live fence is well established and maintained, the owner will be able to count on a certain minimal availability of fuelwood and poles (valued at 8,085 and 41,250 FCFA per m³, respectively) through pruning and sizing the trees to maintain the integrity of the trees in a live fence configuration. It is assumed that the 200 meter long fence (two rows as in the base case alternative 3) will yield up to 0.20 and 0.25 m³ of fuelwood and poles per year beginning in years three and five after stand establishment, respectively (interview with ISRA/Bambey researchers).

B. Seeds

For alternatives 2 and 3, the *Acacia leatea* fence will allow owners to harvest very valuable seeds after a period of 3 to 5 years, by far the most significant benefit of the live fence. Certified acacia seeds of this variety are claimed to fetch as much 40,000 FCFA per kilo, where one mature tree (after five years) may produce as much as five kilos of seeds per year. In a live fence configuration, however, the assumptions are scaled down considerably because farmers will not produce certified seeds and the production will

be much lower as the trees are tightly spaced in a live fence configuration, not for maximum seed production. For these reasons, the assumed farm gate price for the acacia seeds is 1,000 FCFA per kilo, and the volume harvested after five years of growth is only one kilo per tree.³³ The low assumed volume is because: a) the trees are pruned into a live fence configuration every year, and b) the trees are planted in tight spacing and thus will be smaller after five years than trees planted further apart, hence the seed production will be smaller.³⁴

- **Benefits from inside the enclosure :** For all three alternatives, a typical area enclosed would be approximately 1/4 hectare (2,500 m²) of land on which the base case assumes that manioc will be grown. It is assumed that the area is not particularly productive yielding only 1,000 kilos per enclosure in the Fatick and Kaolack regions (or equivalent to 4,000 kilos per hectare), valued at 60 FCFA per kilo. Harvesting is assumed to occur only every two years. In addition to the manioc, there is also value in the leaves. For purposes of the analysis, however, this is not counted in the base case although the analytical framework is designed to accommodate this value.

Table 2.10: Live Fences, Benefits

BENEFITS (OUTPUTS)		Fatick	Kaolack
Manioc harvest commences in year		2	2
Manioc yield inside enclosure (kg)		1000	1000
Manioc harvesting frequency (years)		2	2
Average farm gate price per kg for <i>Acacia leatea</i> seeds per kilo		1000	1000
Alt. 2, FW harvest begins year	3	Alt. 2, m3 of FW harvested/year	0.15
Alt. 2, pole harvest begins year	4	Alt. 2, m3 of poles harvested/year	0.20
Alt. 2, seed harvest begins year	5	Alt. 2, kg seeds harv./ tree/year	1.5
Alt. 3, FW harvest begins year	3	Alt. 3, m3 of FW harvested/year	0.20
Alt. 3, pole harvest begins year	4	Alt. 3, m3 of poles harvested/year	0.25
Alt. 3, seed harvest begins year	5	Alt. 3, kg seeds harv./tree/year	1.5

Sources: a) Karch 1991 and b) Satin 1997

³³ As a point of reference, in Mr. Khassim Ndour's vegetable operation near Dakar, documented in the Limited Assessment report (1998), the seeds from his *Leucaena leucocephala* live fences around his farm plots are harvested and sold for a farm gate price of 10,000 FCFA per kilo. His live fences were established more as windbreaks than protection against livestock intrusion, to provide fodder supplements for his livestock operations, and to provide biomass for his composting operations.

³⁴ It is not known how widespread or robust the market for the acacia seeds is. For purposes of the analysis it is assumed that there is a strong market as claimed by ISRA/Bambey. It would also be interesting to compare the value of these seeds to the value of other live fence species producing pods and/or fruits.

2.5 Field Trees

The field tree intervention appears, on the surface, to be the simplest to extend and the most convincing to intended beneficiaries among all of the NRM technologies tested. All farmers know that the presence of Kad trees (*Faidherbia albida*) causes crop yields to increase, that the trees provide shade and some fuelwood, all of which leads to the conclusion that farmers should, all else being equal, expend some effort to protect them. The problem, however, is that young trees (natural regeneration) are difficult, if not impossible, to protect against livestock browsing and/or trampling during the dry season unless closely guarded. Once regenerated, the trees will remain small for several years to allow the root systems to firmly establish and, as such, are easy prey for the livestock. There are only two options: a) spend time guarding the young Kad trees during the critical time periods, or b) construct protection devices around the trees to prevent the livestock damages. The latter is the most effective for good reason (as claimed by ISRA researchers), yet the most troublesome because the protection devices will cost out-of-pocket cash. Although the option of protecting the young trees with thorn branches is available, it is not very effective. Not only does it require the (labor-intensive) removal of thorny biomass from one area (depleting the biomass), it must be replaced each year because, once made into a protective device, it is fast consumed by termites in the three regions. The protection devices (developed by ISRA/Bambey researches) are in the form of iron baskets placed over the young regeneration or seedlings, devices that can be used over and over again.

The iron baskets have not been adopted by farmers on a large scale because they cost out-of-pocket cash (1,500 FCFA each). They are in use only in project areas, and only when they are heavily subsidized. Little emphasis has been placed on providing key information on the economic tradeoffs between different input mixes – investing time for several years in ensuring protection with thorny bushes, or procuring (only once) the iron baskets that can be reused for many years, and/or sold. Both options (with and without baskets) will be tested.

2.5.1 Costs

The cost assumptions for the field trees technology are summarized in **Table 2.11**.

- **Current and optimal incidence of field trees:** The first order of business is to determine the current and optimal incidence of adult Kad trees per hectare. The difference between the two constitutes the investments needed; i.e., moving from the current to the optimal. Based on interviews with ISRA/Bambey researchers, farm fields will typically have a stocking density of no more than four adult Kad trees per hectare, or some 16 trees short of the optimal 20 adult trees per hectare. The investment can consist of two approaches: a) plant the trees, or b) protect naturally regenerated seedlings. For the latter, the desired situation is to identify at least 60 naturally regenerated trees per hectare and protect them, either with the iron baskets or through surveillance, those that are optimally situated in the field (i.e., to ensure proper spacing).

- **Labor costs:** There is little labor expended in the field tree intervention other than for surveying the site to determine where the trees should be planted (or which naturally regenerated trees should be protected), preparing the sites and planting, and continued surveying for the purpose of keeping livestock away. For the alternative with the iron protection baskets, four days of surveillance is assumed. With no protection baskets, the assumed protection surveillance needed is eight days per year.
- **Physical input costs:** These costs include only the iron baskets when this technical alternative is invoked. For purposes of the analysis it is assumed that the trees are naturally regenerated but not in an optimal spacing, of course. The selected seedlings are subsequently protected by the iron baskets at a cost of 1,500 FCFA each and by some minimal supervision (protection labor) per year for four years during which time the trees become firmly established. Note that the analytical framework prepared for this study also accommodates tree planting in addition to natural regeneration (as indicated in **Table 2.11**).
- **Opportunity cost of land:** The opportunity cost of land is minimal, consisting only of the land area displaced by the trees. For this intervention, it is assumed that three m³ of cultivable space will be lost (measured by the size of the tree trunk and the immediate area covered by branches where planting is not possible), or a total of 20 trees x 3 m³ = 60m³ per hectare times the value of millet production foregone.
- **Equipment:** It is assumed that all of the equipment needed to implement the field tree intervention is already available.
- **Subsidies:** As with all of the other technologies tested, the farmer-perspective financial feasibility of the intervention is tested as if no subsidies are available.

Table 2.11: Field Trees, Costs

COSTS (INPUTS)				Fatick	Kaolack
Current incidence of field trees (no. of relatively mature trees per hectare)				4	4
Estimated optimal incidence of field trees per hectare				20	20
Site preparation occurs year	1	No. person days per hectare		0	0
Field tree planting occurs in year	1	Planting labor, no. of person days		0	0
Replanting occurs in year	2	Mortality (%) to be replanted		0%	0%
Seedling costs delivered to planting site (FCFA each)				0	0
Protection labor needed, no. of years after tree establishment				4	4
Days/year prot. labor per year, with baskets	4	8	days without baskets	4	4
Protection baskets made, year	1	1500	Cost/basket (one per tree)	1500	1500
Estimated cultivable area displaced by the trees (m2)				3	3
Equip. level available to plant/maintain field trees, function of need (%)				100%	100%
Procure additional equip., year	1	Cost/equip. unit (at 100%)		5500	5500
Level of subsidy needed				0.0%	0.0%

Sources: a) Karch 1991, b) interview with Dr. Ibrahim Diaité, ISRA/Bambey, c) Shaikh et al 1988.

Note: the table reflects (in the Fatick and Kaolack columns) the assumptions pertaining to the “with iron baskets” technical alternative. Results from both alternatives will be presented in **Section 3** below.

2.5.2 Benefits

The benefits associated with the field tree intervention are summarized in **Table 2.12**. They consist of three quantifiable benefits: a) a gradual increase in crop yields over time, b) fuelwood from pruning and tree management, and c) pods and leaves.

- **Increased crop yield:** The increased crop yield over time is difficult to determine – there is little hard documented information available. The estimates provided in **Table 2.12**, adapted from Karch (1991) and from interviews with ISRA Bambey researchers, show a gradual increase in crop yields as the trees get larger over and beyond the initial crop yields indicated in **Table 2.12**. Two technical options are analyzed: a) protection with iron baskets, and b) protection through surveillance only. The crop yield increases for the latter are assumed to be 10 percent lower on the average than for the former option. This is to reflect the less than optimal tree spacing achieved without the protection baskets.
- **Other benefits:** The other benefits, fuelwood, leaves and pods, are fairly insignificant, yet they are (and should be) counted as a return on the investments. In order to optimize the growth and beneficial impact of the trees as they grow, they need to be pruned occasionally which will provide some fuelwood (occasionally some poles), estimated here to be 0.3 m³ per hectare per year beginning in year 5, and increasing by five percent every year thereafter as the trees grow. As a point of reference, the assumed fuelwood yield is probably an underestimate in view of detailed research conducted on pollarding Kad trees in Ethiopia (Christophersen, 1997). In this research it was found that each adult tree would typically yield 0.168 m³ of fuelwood per year based on a sample of 50 trees pollarded that yielded a total of 8.4 m³, or 8.4 m³/50 trees = 0.168 m³ per tree. The assumption used for the analysis here far lower – only 0.30 m³ per hectare to account for the fact that the growth and yield for the *Faidherbia albida* in Senegal is considerably lower than for the Kad in Ethiopia. Finally, based on field interviews, it is estimated that 16 additional adult trees per hectare will yield at least 150 kg of pods and leaves of commercial value per year valued at 80 FCFA per kilo. This is probably also an underestimate, but assumed nevertheless since farmers are not protecting the trees for the commercial value they can obtain from the incidental benefits (fuelwood, pods and leaves), rather, the trees are protected first and foremost because of the positive influence they have on crop yields.

Table 2.12: Field Trees, Benefits

BENEFITS	Year	%		Fatick	Kaolack
Millet yield increases	1	0.0%	FW harvest begins year	5	5
"	2	0.0%	FW volume harvested, m3 (when harvest begins)	0.30	0.30
"	3	0.0%	Increased FW vol. harv., %/year as trees get larger	5%	5%
"	4	2.0%	Farm gate price for pods/leaves, FCFA/kg	80	90
"	5	4.0%	Pod and leaf harvest begins year	4	4
"	6	5.0%	Pod and leaf harvest volume, kg per year	150	150
"	7	10.0%	Pod & leaf volume increase, %/yr as trees get larger	5%	5%
"	8	15.0%	Current millet yield, kilos per hectare	400	500
"	9	17.0%			
"	10	19.0%			
"	11	22.0%			
"	12	25.0%			
"	13	30.0%			
"	14	32.0%			
"	15	33.0%			

Sources: a) Karch 1991, b) and interview with Dr. Ibrahim Diaité, ISRA/Bambey, c) Shaikh et al 1988.

Note: the table reflects the “with iron baskets” technical alternative. Both alternatives will be tested in **Section 3** below.

2.6 Rock Dikes

The rock dike intervention is well known throughout Senegal and strongly promoted by donors and NGOs involved with NRM. The intervention involves back-breaking work, however, and farmers are reluctant to adopt it on the basis of its own merit without receiving subsidies of some form, perhaps help with mining and transporting the rocks. CBNRM, for example, provides matching grants to farmers who implement rock dike interventions approved by the NRM committees.

2.6.1 Costs

The costs are summarized in **Table 2.13**.

- Labor:** Labor is by far the most dominant input for this NRM technology. Analyses of rock dike installations will typically value the labor input at near or equal to zero because the opportunity cost of time is perceived to be very low (i.e., farmers are not salaried and, thus, are not giving up any income-earning productivity in order to work on installing the rock dikes). For purposes of this analysis, however, the opportunity cost of time is valued at the full 800 FCFA per day under the assumption that both men and women actively pursue alternative employment during the dry season – the women usually pursue small (petit) commerce activities and the men will go to Dakar or other cities in search of employment. Moreover, the opportunity cost of time should rarely (if ever) be

valued at zero because even leisure time has value. It is assumed that the installation of 100 meters of rock dikes will require 30 man-days including mining and transporting the rocks to the site and installing them along the contours in the field. This reflects an area where the rocks are located nearby and are relatively easy to mine. If the rocks are not relatively accessible, the farmers will be most reluctant to implement this intervention unless subsidized in some form. It is further assumed that another 10 man-days will be needed per year to repair and maintain the dikes once installed.

To digress for a moment, it is opportune to note that rock dikes are, by far, the most taxing of all anti-erosive field technologies available. When the consciousness of the ills of erosion is raised among the farming communities and there is impetus to do something about the problem, then it is probable that other less taxing methods will be considered before the rock dikes, particularly in areas where rocks are not abundant. Extension workers should, in such cases, add techniques such as anti-erosive live fences, vetiver grass planted in strips along the contours, or simply leaving vegetative bands uncultivated (also along the contours) throughout the farm landscape to their extension portfolios. The objective is to slow down the movement of the water during heavy rainfall to allow infiltration to occur. All of these technologies will accomplish this, albeit not always at the same levels of efficiency. For purposes of the analysis here, however, only anti-erosion rock dikes are considered.

- **Transportation:** A budget of 60,000 FCFA is allocated to cover the cost of transporting the rocks from the mining site to the farm fields (by charettes)., This assumes that the two (the mining site and the farm field) are located reasonably close together.
- **Equipment:** It is assumed that 80 percent of the equipment needed (picks, shovels) is already available, hence only 20 percent would be procured. This assumption could also reflect the cost of the rental of charettes to transport the rocks.
- **Subsidies:** As with the other interventions, subsidies are not considered in the base case analysis.

Table 2.13: Rock Dikes, Costs

COSTS (INPUTS)		Fatick	Kaolack
Site preparation occurs year	1 Person days/100 m (mining, loading, unloading)	15	15
Labor to build the dikes, person days		20	20
Maintenance begins year	2 Person days/100 m/year	5	5
Transportation of rocks to site, FCFA (charette loads)		60000	60000
Equip. level available to install & maintain dikes, function of need (%)		80%	80%
Procure additional equip., year	1 Cost/equip. unit (at 100%)	5500	5500
Level of subsidy needed		0.0%	0.0%

Sources: a) Interview with Dr. Modou Sene, ISRA/Bambey, b) Shaikh et al, 1988.

2.6.2 Benefits

On the benefit side, only crop yield increases relative to the crop yield declines without the intervention are considered (see also composting). These variables, however, is inherently difficult to specify because yield changes are clearly a function of the slope of the land and how many meters of dikes will be needed in order to restore the site to higher productivity. All sites vary in these respects – some need simple gully plugs in critical areas, other need several lines of dikes along the contours of perhaps several 100 meters. It is highly site specific. One cannot state categorically that the rock dike intervention is financially feasible under all conditions. For purposes of the this analysis, it is assumed that the site in question is in need of 100 meters of dikes properly sited along the contours that will require 30 man days to install the dikes, and that, once installed, crop yields will increase by 50 percent in the Fatick region and 10 percent more (to 55 percent) in the Kaolack region. These assumptions, of course, will be varied in the sensitivity analysis.

Table 2.14: Rock Dikes, Benefits

BENEFITS (OUTPUTS)	Fatick	Kaolack
Average crop yield increase per year (%) as a result of the rock dikes	50%	55%
% crop yield decline over time, no rock dikes scenario	2.5%	2.5%

Sources: a) Adapted from Karch 1991, and b) interview with Dr. Modou Sene, ISRA/Bambey

2.7 Woodlots

Conventional wisdom about woodlots in most Sahelian countries is that they do not work, the yields are far too low as are the prices. Moreover, forest policies in the majority of countries are not particularly conducive to private production of wood (primarily fuelwood and poles). Nevertheless, woodlots are strongly promoted in an agroforestry context as a means to revegetate the farm landscape and, most importantly to alleviate the growing fuelwood shortages. On the latter point, however, the fuelwood production strategy has been a dismal failure. Current forest policy does not explicitly address the "free good" problem where the fuelwood is available to anyone willing to collect and transport it (with the exception of the sum total of the costs incurred along the way between "the stump" and the final market). Because the wood itself is essentially free, there is little or no incentive for the private sector to produce it. In order to promote private fuelwood production, therefore, the policies will have to change to make production a financially attractive and competitive land use activity. Moreover, a focus on fuelwood production is a non-starter. No wood producer will cut up a perfectly straight eucalyptus tree into small fuelwood pieces if the same tree can be sold as a pole for a much higher market price. It must be recognized that most of the wood will be sold as poles, not fuelwood, only the volume in branches and tops will qualify as fuelwood.

The economics of private woodlots has not been well documented in the literature. Karch (1991), a notable exception for Senegal, derived a 32-percent IRR for block plantations. Little information on the assumptions used to derive this results was provided, however.

2.7.1 Costs

The cost assumptions are summarized in **Table 2.15**.

- **Physical input costs:** The physical inputs for the woodlot intervention are the tree seedlings which, of course, are a function of the tree spacing. A 4 x 4 meter spacing is assumed (Karch 1991), or 625 seedlings (*Eucalyptus camaldulensis*) to procure and plant at an average (unsubsidized) cost of 70 FCFA per seedling.
- **Labor:** labor will be required for planting, replanting, weeding, and protecting the stand once installed. Preparing and planting the site will require a total of 20 person days given the 4 by 4 meter spacing (625 seedlings). This assumes that farmer woodlots will be less intensive than government woodlots. Farmers will be less rigorous with site preparation, tree spacing, and weeding regimes. Nor will they likely invest in pesticides. A 90-percent survival rate is assumed, hence 10 percent will be replanted in year 2. Weeding is highly recommended, although many farmers are often not particularly prone to follow the “blueprints”. It is, nevertheless, assumed that appropriate TA will convince farmers that weeding is essential, at least around the trees with dabas, requiring an estimated eight person days per hectare given the assumed trees spacing. With a relatively wide spacing it is also possible (and cost-effective) to weed mechanically with animal traction. It is assumed that fairly intensive weeding occurs once during the first year (requiring 10 person days) followed by a less intensive weeding regime around the trees only the second year (requiring five person days). Finally, once the stand has been planted and is growing, some supervision (guarding) is recommended in order to protect against theft and other calamities (10 person days).
- **Opportunity cost of land:** For the base case it is assumed that the opportunity cost of land is zero; i.e., the farmer will not be favorably disposed to give up cultivable space for the purpose of growing trees, particularly in view of the long time period between making the investments and reaping the benefits. Trees will typically be grown on marginal land where other crops will not grow well, or on areas not used intensively for other purposes. The analytical framework developed for this study, however, accommodates an opportunity cost of land variable for the woodlot intervention. This variable should be activated if the trees are, indeed, planted on cultivable space. Given the assumed wide spacing of the trees, it will also be possible to intercrop with millet (or other crops) for at least one, probably two years. The opportunity cost variable will be invoked in breakeven scenarios in the analysis to test the threshold opportunity cost of land – where the benefits just equal costs in a present value sense.
- **Equipment:** It is assumed that 100 percent of the equipment needed (picks, shovels) is already available.
- **Subsidies:** As with the other interventions, subsidies are not considered in the base case analysis.

Table 2.15: Woodlots, Costs

COSTS (INPUTS)					Fatick	Kaolack
Tree spacing	4	meters	by		4	4
Site preparation, year	1	Labor expended, person days			10	10
Planting, year	1	Labor expended, person days			10	10
Replanting, year	2	Mortality (%) to be replanted			10.0%	10.0%
Weeding 1, year	1	Frequency/year	1	Person days/yr	10	10
Weeding 2, year	2	Frequency/year	1	Person days/yr	5	5
Weeding 3, year	3	Frequency/year	1	Person days/yr	0	0
Seedling costs					70	70
Plantation protection costs, person days per year (guards)					10	10
Opportunity cost of land per hectare					0	0
Equipment level available expressed as function of need (%)					100%	100%
Procure equip. year	1	Est. cost/equipment unit as defined (at 100%)			5500	5500
Level of subsidy needed					0.0%	0.0%

Sources: a) adapted from CBNRM standard cost estimates, b) Karch, 1991, and c) interview with Dr. Ibrahim Diaité, ISRA/Bambey

2.7.2 Benefits

The benefit derived from the woodlots, of course, is the wood, notably fuelwood and poles. The critical variables are: a) the yields, b) when the harvesting occurs, and c) the split between the two major products, fuelwood and poles.

- Yields:** how fast do eucalyptus trees grow? In government plantations, for example, or plantations established under the auspices of USAID's reforestation project (PRS), the sites chosen would rarely support a growth rate and yield exceeding five m³ per hectare per year. At this low rate, it would be very difficult to achieve financial feasibility unless the stumpage prices were also very high. The objective of the woodlot technology, however, is to convince farmers that growing wood is a financially attractive alternative – that they would be financially better off with such plantations than without them. This means that the private sector would not opt to produce wood on the typically low productive sites used for government plantations, but would plant trees where the yields will be higher and the rotations shorter. Based on interviews with ISRA/Bambey researchers, wood yields of the order of 8 to 9 m³ per hectare per year are not uncommon on the reasonably productive sites. For purposes of the analysis, therefore, yields of 7 and 8 m³ per hectare per year are assumed for the Fatick and Kaolack regions, respectively. These yields are assumed to be harvested every five years; i.e., harvests will occur on years 5, 10, and 15. It is further assumed that the yields will increase substantially for the coppice rotations (after the initial rotation) as multiple stems with good form will grow from the same root system.
- Products:** Two products are considered: fuelwood and polewood. The split between these is expressed in percentage terms as indicated in the table, 15 percent in fuelwood, and 85 percent in polewood.

Table 2.16: Woodlots, Benefits

BENEFITS (OUTPUTS)	Fatick	Kaolack
Production, m3/hectare/year	7	8
Harvest 1, year	5	5
Harvest 2, year	10	10
Harvest 3, year	15	15
2nd & 3rd rotation, increased wood yield	20.0%	22.0%
Harvest 1, volume in fuelwood	15.0%	15.0%
Harvest 2, volume in fuelwood	15.0%	15.0%
Harvest 3, volume in fuelwood	15.0%	15.0%
Harvest 1, volume in polewood	85.0%	85.0%
Harvest 2, volume in polewood	85.0%	85.0%
Harvest 3, volume in polewood	85.0%	85.0%

Sources: a) Karch, 1991, b) interview with Dr. Ibrahim Diaité, ISRA/Bambey

2.8 Improved Stoves

Promotion and dissemination of improved wood stoves is widely held to be a much more cost-effective way to save wood as opposed to producing more wood to meet population-driven increases in demand over time (as discussed in **Section 1** above). This is so because the improved stoves are known to save more than 25 percent of the wood vis-a-vis the 3-stone stove because of higher thermal efficiencies. If everyone now cooking on the 3-stone stove were to use such improved stoves, producing an equal volume of the wood saved would require far more hectares of plantations than Senegal has available. The improved woodstove analyzed in this report can be manufactured from a clay and manure mix and can be produced in most parts of the country. The assumptions are summarized in **Table 2.17**.

- Labor:** The major cost associated with the improved clay stove is the opportunity cost of time involved in building the stoves. Estimates range from one hour to more than one day, depending on the availability of materials. If all the ingredients are in place, the experts claim the stove can be built in one hour. If they have to be collected, the process takes much longer. For purposes of the analysis, it is assumed that the process of building the stove requires four hours. It is further assumed that only one stove that can accommodate three different size cooking pots (marmites) is built for each household. The other labor category of significance is the time spent collecting wood. A very conservative estimate (probably an underestimate) is that women would spend an average of at least one hour per day collecting fuelwood in the Fatick region (slightly less so for the Kaolack and Thies regions). She will typically collect fuelwood three days per week spending several hours each time.
- Wood savings:** A universal estimate of the thermal efficiency of the 3-stone stove is 10 percent or lower (i.e., 90 percent of the energy expended dissipates, only 10 percent is used directly). The

improved clay/manure stove in Senegal is claimed to have an efficiency rating of at least 25 percent, the difference between the two translates into the volume of wood saved. If the average fuelwood consumption in the three regions is 0.66 kg per capita using the 3-stone stove as assumed (interview with ISRA/Bambey), then the improved stove could reduce the wood consumption to 0.56 kilos per person per day ($0.66 \times 85 \text{ percent} = 0.56 \text{ kilos}$) in accordance with the differences in the thermal efficiency ratings. In reality, however, the actual savings are much lower because: a) not all meals will be cooked on the improved stove (only 70 percent is assumed for the Fatick region), and b) fuelwood is also burned in open fires for other purposes such as for heat, lighting, and aesthetics (25 percent of all fuelwood collected is assumed to be burned in open fires). In addition, not 100 percent of all households in the region will build the improved stoves (only 65, 70, and 75 percent is assumed for the Fatick, Kaolack, and Thies region, respectively, for purposes of the analysis). The projected wood savings impact of a stoves program, therefore, should always be tempered with these field realities. What is probably more important, however, is the time saved for the women who use the stove as they will spend less time collecting the wood, and use the extra time in commercial pursuits.

Table 2.17: Improved Stoves, Costs and Benefits

COSTS (INPUTS)	Fatick	Kaolack
Time spent manufacturing the stove, hours	4	4
Wood consumption per capita, kg/day	0.66	0.66
Conversion, kilos of fuelwood per solid m3	650	650
Average household size	6	6
Time spent collecting wood for 3-rock stove (hours/year)	365	300
Current stove efficiency (3-rock)	10.0%	10.0%
Improved stove efficiency	25.0%	25.0%
Total no. of households in impact region	114166	181710
Estimated no. of households adopting the improved stove technology	65.0%	70.0%
Estimated no. of all meals cooked on improved stove (or boiling water)	70.0%	75.0%
Wood burned for purposes other than cooking (i.e., for aesthetics, heat, light)	25.0%	20.0%
No. stoves built per household	1	1

Sources: Interview with Tostan NGO, Thies

2.9 Context of the Assumptions and Analysis

The assumptions briefly summarized and discussed above reflect variables in the analytical framework developed for this study. Changes in any of these variables will cause changes in the overall results. How these initial assumptions develop into projections over time is shown in the detailed annex results tables (**Annex 2**). The focus of the analytical framework is, first and foremost, to flesh out the farmers' perspectives on the proposed NRM technologies; i.e., all of the interventions must make financial sense to them, otherwise adoption will not likely be forthcoming. It should be clearly understood at the outset

that the analytical assumptions used may not always reflect the magnitudes of variables obtained under research conditions. The point of departure for the development of the assumptions is always documented research data found in the literature – it is, however, adapted more often than not to reflect realistic field conditions. Farmers, for example, will typically implement field interventions in their own way, not in accordance with "blueprints" prepared by outsiders or as indicated in the research technical specifications. A government tree plantation will typically be very intensive in site preparation and subsequent silvicultural management, whereas a community-based or individual plantation will be much less intensive. Yields will generally be higher in the government plantations, but so will costs. The assumptions and variables created and analyses carried out here, therefore, reflect the field perspective more so than the government perspective.

3.0 Financial Analysis

3.1 Introduction

This section presents the results of the financial analysis per hectare for the different NRM technologies from the perspectives of the intended beneficiaries. These results *reflect the financial attractiveness of the interventions without any subsidies or direct financial incentives* with the exception of extension advice supported through USAID. Where the NPV results are positive or the IRRs are greater than the assumed opportunity cost of capital (defined as 30 percent for this analysis), therefore, the interventions do not (at least theoretically) require subsidies in order to ensure adoption. If the subsidies had been included in the analysis, the results would have been more attractive than those presented in **Table 3.1**. The purpose of the analysis, however, is to judge the NRM interventions on their own merits since USAID's support will not be available in perpetuity. If the interventions are financially feasible without the subsidies, then there is much stronger reason for the GOS to vigorously promote them once the donor support has ended, and to gradually phase out any subsidies the donors may have initiated.

The net cash flow results for the field activities are summarized in **Table 3.1** with detailed results provided in **Annex 2**. The results indicate that all interventions are financially attractive in the Kaolack region, only the rock dike intervention is slightly negative in the Fatick region (almost to the breakeven point, however, as indicated by the 27.8 IRR which is close to the 30-percent assumed opportunity cost of capital), given the assumptions. The improved woodstoves were not subjected to benefit/cost analysis.

Table 3.1: Financial Analysis Base Case Per Hectare Results (FCFA)

Technologies	NPV		IRR	
	Fatick	Kaolack	Fatick	Kaolack
Composting	34902	60,893	NA	NA
Live fences	290895	342138	56.2%	69.6%
Field trees	16477	18096	52.4%	53.8%
Rock dikes	-3874	22962	27.8%	NA
Woodlots	12157	26381	33.8%	37.9%
Imp. stoves	NA	NA	NA	NA

Note: NA means "not applicable". NPVs and IRRs were not computed for the improved stoves. For some of the other interventions the IRRs could not be computed because of the nature of the net cash flows.

3.2 Farmer-Perspective Results

3.2.1 Composting

Beginning with composting, costs and benefits for the base case – the least costly and alternative – are summarized in **Tables 3.2 - 3.5**. **Tables 3.2** and **3.3** show a detailed breakdown of the costs per pit, and the breakdown of the benefits per hectare (since one pit is assumed to accommodate one full hectare as assumed in the previous section) for the Fatick region. **Tables 3.4** and **3.5** show the same for the Kaolack region. As indicated, composting is financially feasible in both regions, given the assumptions since the NPVs are positive.

Table 3.2: Summary of Costs per Pit, Composting Fatick

Year	Construction Costs	Maintain Structure	Biomass Empty/Fill lab.	Op. Cst Watering	Labor Phosphate	Apply Imp-roved Seeds	Procure Equipment	Total
1	4,000	1,600	3,200	2,400	0	0	3,500	14,700
2-15	0	1,600	3,200	2,400	0	0	0	7,200
PV								29,300

Table 3.3: Summary of Benefits, Costs, and Net Cash Flows, Fatick

Year	Benefits, Alternative 1		Benefits, Alternative 2		Benefits, Alternative 3		Costs	NCF per Year
	Kg millet	Price x Volume	Kg millet	Price x Volume	Kg millet	Price x Volume		
1	168	16,800	0	0	0	0	14,700	2,100
2	178	17,800	0	0	0	0	7,200	10,600
3	188	18,775	0	0	0	0	7,200	11,575
4	197	19,726	0	0	0	0	7,200	12,526
5	207	20,652	0	0	0	0	7,200	13,452
6	216	21,556	0	0	0	0	7,200	14,356
7	224	22,437	0	0	0	0	7,200	15,237
8	233	23,296	0	0	0	0	7,200	16,096
9	241	24,134	0	0	0	0	7,200	16,934
10	250	24,951	0	0	0	0	7,200	17,751
11	257	25,747	0	0	0	0	7,200	18,547
12	265	26,523	0	0	0	0	7,200	19,323
13	273	27,280	0	0	0	0	7,200	20,080
14	280	28,018	0	0	0	0	7,200	20,818
15	287	28,738	0	0	0	0	7,200	21,538
NPV								34,902
IRR								NA

Table 3.4: Summary of Costs per Pit, Composting Kaolack

Year	Construction Costs	Maintain Structure	Biomass Op. Cst Empty/Fill lab.	Labor Watering	Apply Phosphate	Apply Imp- roved Seeds	Procure Equipment	Total
1	0	1,600	3,200	2,400	0	0	3,500	10,700
2-15	0	1,600	3,200	2,400	0	0	0	7,200
PV								26,223

Table 3.5: Summary of Benefits, Costs, and Net Cash Flows, Composting Kaolack

Year	Benefits, Alternative 1		Benefits, Alternative 2		Benefits, Alternative 3		Costs	NCF per Year
	Kg millet	Price x Volume	Kg millet	Price x Volume	Kg millet	Price x Volume		
1	231	23,100	0	0	0	0	10,700	12,400
2	244	24,350	0	0	0	0	7,200	17,150
3	256	25,569	0	0	0	0	7,200	18,369
4	268	26,757	0	0	0	0	7,200	19,557
5	279	27,916	0	0	0	0	7,200	20,716
6	290	29,045	0	0	0	0	7,200	21,845
7	301	30,147	0	0	0	0	7,200	22,947
8	312	31,220	0	0	0	0	7,200	24,020
9	323	32,267	0	0	0	0	7,200	25,067
10	333	33,288	0	0	0	0	7,200	26,088
11	343	34,284	0	0	0	0	7,200	27,084
12	353	35,254	0	0	0	0	7,200	28,054
13	362	36,200	0	0	0	0	7,200	29,000
14	371	37,123	0	0	0	0	7,200	29,923
15	380	38,022	0	0	0	0	7,200	30,822
NPV								60,893
IRR								NA

These results were obtained by invoking the least intensive of the three technical alternatives (composting only, no other physical inputs). For alternatives 2 (composting plus phosphates) and 3 (composting plus phosphates plus improved seeds), the NPV results only are summarized in **Table 3.6** for the two regions. It is obvious that the addition of the phosphate and improved seeds inputs generate a substantial boost in the economic attractiveness of composting as indicated by the relatively large differences between the NPVs.

Table 3.6: Summary of NPVs per Hectare, All Technical Alternatives

Alternatives	Fatick		Kaolack	
	NPV	IRR	NPV	IRR
1 BASE CASE (Composting only)	34,902	NA	60,893	NA
2 (Composting + phosphates)	101,751	NA	153,718	NA
3 (Composting + phosphates + improved seeds)	157,272	NA	232,345	NA

Note: NA = not applicable. This is because none of the alternatives generate any negative cash flows during the early years, the benefits are greater than the costs for all years.

In addition to the differences in the results between the three technical alternatives as indicated in **Table 3.6**, recall also that they were achieved with a zero opportunity cost for the biomass. If markets for the uncontested biomass (as discussed in the previous section) were developed, then it would be necessary to invoke the opportunity cost variable. For now, however, this is used as a calibrating variable to test how much the farmer could pay for the biomass he needs, or alternatively, how much commercial value would he forego by not selling his biomass but use it for his own composting needs instead, defined by the point where the NPV equals zero, or where costs just equal benefits in a present value sense. The results are presented in **Table 3.7**. For the base case, the farmer would be better off selling his biomass instead of composting it if he were paid more than 1.3 and 2.3 FCFA per kilo for it in the Fatick and Kaolack regions, respectively. For the 3rd alternative, these breakeven opportunity costs increase to 6.0 and 8.9 FCFA for the two regions, respectively. These results clearly show that the composting technology is extremely sensitive to the availability and value of biomass. The reason for assuming the zero opportunity cost in the first place is because the biomass used in composting is uncontested, as discussed in the previous section; i.e., there currently is no commercial market. On the basis of this assumption, all of the three composting technologies are financially feasible. If, however, some budding entrepreneurs seize upon the opportunity to create a composting business, then markets for the uncontested biomass would emerge rapidly.

Table 3.7: Breakeven Opportunity Cost of Biomass

Alternatives	Breakeven Opportunity Cost of Biomass	
	Fatick	Kaolack
1 BASE CASE (Composting only)	1.3 FCFA/Kg	2.3 FCFA/Kg
2 (Composting + phosphates)	3.9 FCFA/Kg	5.9 FCFA/Kg
3 (Composting + phosphates + improved seeds)	6.0 FCFA/Kg	8.9 FCFA/Kg

There is considerable (and valid) argument about whether there is a need to invest in the cement compost pits in view of the fact that farmers are cash poor and the rate of adoption of cement pit composting has been dismal, at best. Farmers appear to only adopt if projects heavily subsidize the construction of the pits. The alternative of above-the-ground or clay pit composting (as analyzed here) is often suggested as a viable solution because it would avoid the cash investments in cement and construction equipment. The argument against above-the-ground or clay pit composting is that the quality of the compost will be compromised because of the absence of any solid structure to retain water and nutrients. As indicated by the above results, however, financial feasibility is attained if the resulting crop yields as assumed are, indeed, valid. For the future, it is very important to reconcile the differences between cement pit composting and the technical alternatives considered here in economic and financial terms. It may well be that the investment in the construction and maintenance of cement pits will pay off handily in the long run. If so, they will be

worthwhile extending to the local farmers instead of the clay pits. For the time being, however, it is confirmed that composting along the traditional lines (above-ground and/or in clay pits, is financially feasible from the farmer's perspective, given the assumptions. Moreover, it is strongly recommended that farmers are well informed (through demonstrations) about the differences between the three alternatives – the fact that the returns to the additions of low cost physical inputs (phosphates and improved seeds) will generate very attractive returns.

3.2.2 Live Fences

The per hectare results for the live fence intervention indicate very strong financial feasibility, in fact, by far the strongest of all of the NRM technologies analyzed in this study. Given the assumptions, it appears that the fence itself will generate far more financial benefits to the farmers than the cash crops grown inside the enclosed areas (manioc as assumed in the base case). If, indeed, the market for *acacia leatea* seeds is as strong as claimed by ISRA researchers, then it is obvious that many farmers could benefit considerably from abandoning the traditional salane live fences and instead plant *acacia leatea* fences, thus enabling them to collect revenues from the harvest and sale of the seeds, fuelwood, and poles in addition to the revenues from the manioc production. In fact, because the intervention is so attractive, farmers ought to consider establishing *Acacia laetea* woodlots to maximize the production of seeds rather than establishing only the live fences and for the purpose of producing a much lower value crop inside, i.e., manioc (albeit higher in total value to the farmer than millet). Suggesting acacia woodlots at this time may be too far fetched, however, in recognition of the fact that changes in traditions are slow to take root. Farmers will typically prioritize survival schemes; i.e., produce enough food to provide for the family before other options are tried. The idea of foregoing basic food production and instead produce higher value crops (and thus higher incomes) is still a foreign concept – the notion that high incomes will enable them to purchase the foodstuffs they need to feed their families instead of producing it is still remote. Any change in deeply rooted traditions will have to come about very slowly. Hence, the first step should be encourage farmers to plant live fences using species different from the traditional ones (i.e., salane) and instead plant species that will generate revenues in addition to the incomes earned from the protected crops grown inside the enclosures. If this works well, some will eventually break out understanding that the perimeter fence is much more valuable than what it encloses and will then begin to convert land to higher and better economic uses – others will eventually follow. The detailed cash flow results are presented in **Tables 3.8 - 3.11** for the base case alternative (no. 2 – see assumptions in **Section 2** above).

Table 3.8: Summary of Costs, Live Fences Fatick

Year	Fence Planting	Maint. of Replantin g	Fence (Labor)	Site Prep. & Plant Manioc	Labor During Crop Season	Opp. Cost of Land	Procure Equipment	Total
1	120,000	0	3,200	13,000	12,000	20,000	1,100	169,300
2	0	18,000	3,200	8,000	12,000	20,000	0	61,200
3-15	0	0	3,200	8,000	12,000	20,000	0	43,200
PV								248,838

Table 3.9: Summary of Benefits, Costs, and Net Cash Flows, Live Fences Fatick

Year	Alternative 1		Alternative 2		Alternative 3		Costs	NCF per Year
	Manioc & Leaves	Wood & Other	Manioc & Leaves	Wood & Other	Manioc & Leaves	Wood & Other		
1	0	0	0	0	0	0	169,300	(169,300)
2	0	0	60,000	0	0	0	61,200	(1,200)
3	0	0	0	1,200	0	0	43,200	(42,000)
4	0	0	60,000	9,400	0	0	43,200	26,200
5	0	0	0	409,400	0	0	43,200	366,200
6	0	0	60,000	409,400	0	0	43,200	426,200
7	0	0	0	409,400	0	0	43,200	366,200
8	0	0	60,000	409,400	0	0	43,200	426,200
9	0	0	0	409,400	0	0	43,200	366,200
10	0	0	60,000	409,400	0	0	43,200	426,200
11	0	0	0	409,400	0	0	43,200	366,200
12	0	0	60,000	409,400	0	0	43,200	426,200
13	0	0	0	409,400	0	0	43,200	366,200
14	0	0	60,000	409,400	0	0	43,200	426,200
15	0	0	0	409,400	0	0	43,200	366,200
NPV								290,895
IRR								56.2%

Table 3.10: Summary of Costs, Live Fences Kaolack

Year	Fence Planting	Replanting	Maint. of Fence (Labor)	Site Prep. & Plant Manioc	Labor During Crop Season	Opp. Cost of Land	Procure Equipment	Total
1	60,275	0	3,200	13,000	12,000	20,000	1,100	109,575
2	0	9,041	3,200	8,000	12,000	20,000	0	52,241
3-15	0	0	3,200	8,000	12,000	20,000	0	43,200
PV								197,594

Table 3.11: Summary of Benefits, Costs, and Net Cash Flows, Live Fences Kaolack

Year	Alternative 1		Alternative 2		Alternative 3		Costs	NCF per Year
	Manioc & Leaves	Wood & Other	Manioc & Leaves	Wood & Other	Manioc & Leaves	Wood & Other		
1	0	0	0	0	0	0	109,575	(109,575)
2	0	0	60,000	0	0	0	52,241	7,759
3	0	0	0	1,200	0	0	43,200	(42,000)
4	0	0	60,000	9,400	0	0	43,200	26,200
5	0	0	0	409,400	0	0	43,200	366,200
6	0	0	60,000	409,400	0	0	43,200	426,200
7	0	0	0	409,400	0	0	43,200	366,200
8	0	0	60,000	409,400	0	0	43,200	426,200
9	0	0	0	409,400	0	0	43,200	366,200
10	0	0	60,000	409,400	0	0	43,200	426,200
11	0	0	0	409,400	0	0	43,200	366,200
12	0	0	60,000	409,400	0	0	43,200	426,200
13	0	0	0	409,400	0	0	43,200	366,200
14	0	0	60,000	409,400	0	0	43,200	426,200
15	0	0	0	409,400	0	0	43,200	366,200
NPV								342,138
IRR								69.6%

The NPV results for the other technical alternatives: 1 (the salane fence only), and 3 (one row of salane and two rows of acacia), are summarized in **Table 3.12**. If farmers opt for the salane fence only, they only buy protection for the crops grown inside. No direct benefits are derived from the perimeter fence itself. In this case, the NPVs are negative. Given the assumptions, it is clear that the investments in live fences cannot be recovered only from the production and sale of the crops grown inside the enclosures, but must include also some benefits from the perimeter fences themselves.

Table 3.12: Summary of NPVs per Hectare, Live Fence, All Technical Alternatives

Alternatives	Fatick		Kaolack	
	NPV	IRR	NPV	IRR
1 (1 row salane fence)	-92,019	NA	-92,019	NA
2 BASE CASE (1 row salane, 1 row <i>Acacia laetea</i>)	290,895	NA	342,138	NA
3 (1 row salane, 2 rows <i>Acacia laetea</i>)	683,943	NA	684,706	NA

3.2.3 Field Trees

The field tree technology is financially feasible in both regions since the NPVs are positive, i.e. the technology should be vigorously promoted. It is important to note that, for this particular technology, the benefits occur very late compared with the other NRM technologies which have more immediate benefits, hence, the impact on the present values will be relatively small. The later the benefits and costs occur

during the time horizon analyzed, the less impact they will have on the present values. It is also noted that the protection of Kad trees, although beneficial on their own merit, should be done in conjunction with other technologies such as composting (alternative 3). The synergy between composting and an optimal incidence of adult field trees would be an interesting combination to test, indeed. The detailed cash flow results are presented in **Tables 3.13 - 3.16**.

Table 3.13: Summary of Costs, Field Trees Fatick

Year	Site Preparation	Planting and Replanting	Protection Labor	Protection Baskets	Millet Value Foregone	Procure Equipment	Total
1	0	0	6,400	0	192	0	6,592
2	0	0	6,400	0	192	0	6,592
3	0	0	6,400	0	192	0	6,592
4	0	0	6,400	0	192	0	6,592
5-15	0	0	0	0	192	0	192
PV							14,491

Table 3.14: Summary of Benefits, Costs, and Net Cash Flows, Field Trees Fatick

Year	Millet Yields Kilos per Ha	Millet Yield Value Incr./Ha	Fuelwood	Pods and Leaves	Costs	NCF
1	400	0	0	0	6,592	(6,592)
2	400	0	0	0	6,592	(6,592)
3	400	0	0	0	6,592	(6,592)
4	407	720	0	13,860	6,592	7,988
5	414	1,440	2,520	14,520	192	18,288
6	418	1,800	2,640	15,180	192	19,428
7	436	3,600	2,760	15,840	192	22,008
8	454	5,400	2,880	16,500	192	24,588
9	461	6,120	3,000	17,160	192	26,088
10	468	6,840	3,120	17,820	192	27,588
11	479	7,920	3,240	18,480	192	29,448
12	490	9,000	3,360	19,140	192	31,308
13	508	10,800	3,480	19,800	192	33,888
14	515	11,520	3,600	20,460	192	35,388
15	519	11,880	3,720	21,120	192	36,528
NPV						16,477
IRR						52.4%

Table 3.15: Summary of Costs, Field Trees Kaolack

Year	Site Preparation	Planting and Replanting	Protection Labor	Protection Baskets	Millet Value Foregone	Procure Equipment	Total
1	0	0	6,400	0	240	0	6,640
2	0	0	6,400	0	240	0	6,640
3	0	0	6,400	0	240	0	6,640
4	0	0	6,400	0	240	0	6,640
5-15	0	0	0	0	240	0	240
PV							14,648

Table 3.16: Summary of Benefits, Costs, and Net Cash Flows, Field Trees Kaolack

Year	Millet Yields Kilos per Ha	Millet Yield Value Incr./Ha	Fuelwood	Pods and Leaves	Costs	NCF
1	500	0	0	0	6,640	(6,640)
2	500	0	0	0	6,640	(6,640)
3	500	0	0	0	6,640	(6,640)
4	509	900	0	14,175	6,640	8,435
5	518	1,800	2,520	14,850	240	18,930
6	523	2,250	2,640	15,525	240	20,175
7	545	4,500	2,760	16,200	240	23,220
8	568	6,750	2,880	16,875	240	26,265
9	577	7,650	3,000	17,550	240	27,960
10	586	8,550	3,120	18,225	240	29,655
11	599	9,900	3,240	18,900	240	31,800
12	613	11,250	3,360	19,575	240	33,945
13	635	13,500	3,480	20,250	240	36,990
14	644	14,400	3,600	20,925	240	38,685
15	649	14,850	3,720	21,600	240	39,930
NPV						18,096
IRR						53.8%

If the protection baskets were, the assumptions stated in the previous section indicate an additional 10 percent increase in crop yields because the trees would be better dispersed throughout the farm fields, and they would be better protected. The NPV results associated with this alternative would be lower in both regions, yet still positive and feasible (3,433 and 7,265 FCFA per hectare for the Fatick and Kaolack regions, respectively).

3.2.4 Rock Dikes

Given the base case assumptions, installing rock dikes is financially feasible in the Kaolack region and almost so in the Fatick region. For the latter, the NPV is only slightly negative. The heavy labor expended in the process of mining, transporting, and installing the rocks along the contours in the fields appears to be offset by the value of the crop yield increases obtained as a result. The detailed cash flow results are presented in **Tables 3.17 - 3.20**. Although the rock dike intervention is judged financially feasible on its own merit, the financial attractiveness of improved management of the farm field would be much higher if

rock dikes were but one of several technologies applied on the same field. The combination of rock dikes, field trees, and composting on the same field would, no doubt, generate very attractive results because of the synergies emanating from the interactions between the technologies.

Table 3.17: Summary of Costs, Rock Dikes Fatick

Year	Site Prep., Mine, Load, Unload	Transport Rocks	Build Dikes	Maintenanc e	Procure Equipment	Total
1	12,000	60,000	16,000	0	1,100	89,100
2-15	0	0	0	4,000	0	4,000
PV						78,534

Table 3.18: Summary of Benefits, Costs, and Net Cash Flows, Rock Dikes Fatick

Year	Kg. of Millet	Benefits Price x Volume	Costs	NCF
1	200	20,000	89,100	(69,100)
2	210	21,000	4,000	17,000
3	220	21,975	4,000	17,975
4	229	22,926	4,000	18,926
5	239	23,852	4,000	19,852
6	248	24,756	4,000	20,756
7	256	25,637	4,000	21,637
8	265	26,496	4,000	22,496
9	273	27,334	4,000	23,334
10	282	28,151	4,000	24,151
11	289	28,947	4,000	24,947
12	297	29,723	4,000	25,723
13	305	30,480	4,000	26,480
14	312	31,218	4,000	27,218
15	319	31,938	4,000	27,938
NPV				(3,874)
IRR				27.8%

Table 3.19: Summary of Costs, Rock Dikes Kaolack

Year	Site Prep., Mine, Load, Unload	Transport Rocks	Build Dikes	Maintenanc e	Procure Equipment	Total
1	12,000	60,000	16,000	0	1,100	89,100
2-15	0	0	0	4,000	0	4,000
PV						78,534

Table 3.20: Summary of Benefits, Costs, and Net Cash Flows, Rock Dikes Kaolack

Year	Millet Yields Kilos per Ha	Millet Yield Value Incr./Ha	Costs	NCF
1	275	27,500	89,100	(61,600)
2	288	28,750	4,000	24,750
3	300	29,969	4,000	25,969
4	312	31,157	4,000	27,157
5	323	32,316	4,000	28,316
6	334	33,445	4,000	29,445
7	345	34,547	4,000	30,547
8	356	35,620	4,000	31,620
9	367	36,667	4,000	32,667
10	377	37,688	4,000	33,688
11	387	38,684	4,000	34,684
12	397	39,654	4,000	35,654
13	406	40,600	4,000	36,600
14	415	41,523	4,000	37,523
15	424	42,422	4,000	38,422
NPV				22,962
IRR				44.0%

3.2.5 Woodlots

Woodlots are an anomaly – many will claim they are financially feasible, others care less about the economics and promote them because they revegetate an otherwise degraded landscape, and yet others believe they are dismal economic and financial failures, never to be promoted. The results obtained in this study are not unlike those obtained by Karch (1991) who found block plantations to generate an IRR of 32 percent without any subsidies. The results obtained in the present study indicate an IRR of slightly less than 34 percent in the Fatick region and 38 percent in the Kaolack region. The detailed cash flow results are presented in **Tables 3.21 - 3.24**.

Table 3.21: Summary of Costs, Woodlots Fatick

Year	Site Preparation	Planting and Replanting	Protection Labor	Weeding	Opportunity Cost of Land	Procure Equipment	Total
1	8000	51750	8000	8000	0	0	75750
2	0	5175	8000	4000	0	0	17175
3-15	0	0	8000	0	0	0	8000
PV							83690

Table 3.22: Summary of Benefits, Costs, and Net Cash Flows, Woodlots Fatick

Year	Fuelwood	Polewood	Total Benefits	Total Costs	Year
1	0	0	0	75750	-75750
2	0	0	0	17175	-17175
3	0	0	0	8000	-8000
4	0	0	0	8000	-8000
5	8400	243950	252350	8000	244350
6	0	0	0	8000	-8000
7	0	0	0	8000	-8000
8	0	0	0	8000	-8000
9	0	0	0	8000	-8000
10	10080	292740	302820	8000	294820
11	0	0	0	8000	-8000
12	0	0	0	8000	-8000
13	0	0	0	8000	-8000
14	0	0	0	8000	-8000
15	10080	292740	302820	8000	294820
NPV					12157
IRR					33.8%

Table 3.23: Summary of Costs, Woodlots Kaolack

Year	Site Preparation	Planting and Replanting	Protection Labor	Weeding	Opportunity Cost of Land	Procure Equipment	Total
1	8000	51750	8000	8000	0	0	75750
2	0	5175	8000	4000	0	0	17175
3-15	0	0	8000	0	0	0	8000
PV							83690

Table 3.24: Summary of Benefits, Costs, and Net Cash Flows, Woodlots Kaolack

Year	Fuelwood	Polewood	Total Benefits	Total Costs	Year
1	0	0	0	75750	-75750
2	0	0	0	17175	-17175
3	0	0	0	8000	-8000
4	0	0	0	8000	-8000
5	9600	278800	288400	8000	280400
6	0	0	0	8000	-8000
7	0	0	0	8000	-8000
8	0	0	0	8000	-8000
9	0	0	0	8000	-8000
10	11712	340136	351848	8000	343848
11	0	0	0	8000	-8000
12	0	0	0	8000	-8000
13	0	0	0	8000	-8000
14	0	0	0	8000	-8000
15	11712	340136	351848	8000	343848
NPV					26381
IRR					37.9%

It is important to recall that these results are obtained with the assumption of zero opportunity cost of land. This will severely limit the availability of land for the purpose of establishing private woodlots. If the woodlots were to be established on land currently producing some value, then the NPV results will quickly turn sharply negative. The breakeven opportunity costs of land for the two regions are defined by the point where the NPVs reach zero. For the Fatick region, this value is 3,700 FCFA per hectare, and for the Kaolack region the breakeven value is 8,100 FCFA per hectare. This means that the farmer could afford to convert the land to woodlots in Fatick and Kaolack if it currently generates an annual value of 3,700 FCFA and 8,100 FCFA per hectare, respectively, but not more. Both are far below the opportunity costs of the millet and sorghum land in both regions.

3.3 Results: Improved Wood Stoves

The improved wood stove analysis is different from the other NRM techniques – the stoves are already assumed to be financially feasible from the perspective of the users as the opportunity cost of time of building the stoves is very low compared to the benefits (expressed as both wood and time saved, particularly important for the women who typically collect fuelwood for the household and cook the meals). As stated above, there are no private sector income-generating opportunities associated with the improved clay stoves, the only constraint to adoption is the training needed for the users. The per individual household results are summarized in **Table 3.25**.

Given the assumptions, wood consumption using the 3-stone stove is estimated to reach 1,445 kilos per household per year in all three regions. If the improved stoves were introduced and used properly, there would be substantial savings, however far less than many would claim. Based on the difference in thermal efficiency between the 3-stone (10 percent) and the improved stove (15 percent), consumption should decrease to 1,228 kilos per household ($1,445 \times 85\% = 1,228$ kg) if all of the fuelwood were burned in the improved stove. But this is not so, as discussed above, because: a) not all meals are cooked using the improved stove, and b) not all wood collected is used through the improved stove. Taking all of these factors into account (as assumed in **Table 2.17** above), the actual wood saving per household per year is 114 kilos, from 1,445 to 1,332 kilos.

In terms of time saved, women will only spend 336 hours per year collecting the wood whereas they would spend 365 hours per year for the 3-stone stove in the Fatick region. The savings generated as a result would amount to 2,874 FCFA per year per household expressed in terms of opportunity cost of time. Given these savings, it would take 51 days of using the improved stoves to recover the opportunity cost of time spent in building the stoves.

Table 3.25: Improved Stoves, Savings per Household

Results per Household	Fatick	Kaolack
Wood consumption/HH (kilos/year), 3-stone stove	1445	1445
Wood consumption/HH (kilos/year), improved stove	1332	1315
Wood saving per household (kilos/year)	114	130
Hours spent collecting FW/year for 3-stone stove	365	300
Opportunity cost of time/year collecting fuelwood, 3-stone stove, FCFA	36500	30000
Hours spent collecting FW/year for improved stove	336	273
Opportunity cost of time/year collecting fuelwood, improved stove, FCFA	33626	27300
Opportunity cost of time saved per year per HH, FCFA	2874	2700
Opportunity cost of time saved per day per HH, FCFA	7.9	7.4
Investment in improved stove, labor, FCFA	400	400
No. days of stove use needed to recover investment (opp. cost of time)	51	54

3.4 Sensitivity Analysis

The sensitivity analysis shows how the base case NPV results would change if the assumptions (with respect to costs, prices and the discount rate) were changed. Where a large change in an assumption causes only a small change in the overall result (when the NPV switches from positive to negative), the assumption is not sensitive and need not be so carefully monitored. Where, on the other hand, a small change in an assumption yields a large change in the overall result, that assumption is sensitive and should be closely monitored. The results of the sensitivity analysis for the Fatick region only are presented in **Table 3.26**. The sensitivity of the same variables for the Kaolack region is not tested because of the similarity of the results between the two regions. The same variables exhibiting sensitivity for the Fatick region will also be sensitive in the Kaolack region as well. The base case assumptions on prices, costs, yields, and the cost appreciation rate are reflected in the NPV results in the center column of the table. The effect of varying the assumptions by 10 percent increments above and below the base case assumptions are given in the other columns of the table.

The first parameter to be tested is the impact on the financial analysis results if the benefits (prices and or volumes produced) for the commodities produced under each NRM technology were increased or decreased across the board by 10, 20, or 30 percent. A 10-percent increase in the farm gate millet price, for example, would be from 100 FCFA per kilo as assumed in the base case, to 110 FCFA per kilo. The second parameter tested is the costs, i.e., all costs listed in the assumptions in **Section 2** are increased or decreased by 10-percent increments. The third parameter tested is the discount rate.

- **Composting:** The results indicate that the NPV results are not very sensitive to any changes in the assumptions. Within the full range of variations, none of the NPV results switch from positive to negative. This means that the technique can tolerate at least a reduction of more than 30 percent in benefits, more than a 30-percent increase in costs, and more than a 30-percent increase in the discount rate (i.e., from 30 percent as in the base case, to 39 percent) before the NPV switches to negative. The NPVs remain strongly positive throughout.

- **Live fences:** This intervention is, by far, the most attractive among the technologies tested. Any variation up to plus or minus 30 percent in any of the variables will not switch the NPV from positive to negative. The NPVs remain strongly positive throughout.
- **Field trees:** The field tree intervention is also not sensitive to variations as none of the changes in assumptions up or down produce a switching of the NPV from positive to negative.
- **Rock dikes:** The results indicate that the NPV results are very sensitive to changes in the assumptions. This is expected, of course, since the base case NPV is already very close to zero. Any increase in the benefits will switch the NPV from the slightly negative to positive as indicated in the table.
- **Woodlots:** As expected, the woodlot intervention is sensitive to changes in the assumptions since the base case results are just above the breakeven point where costs just equal revenues. A less than 10-percent increase in benefits or a less than 10 percent decrease in costs will switch the NPV results from negative to positive. Likewise, a small decrease in the discount rate will also switch the NPV value from negative to positive.

Table 3.26: Sensitivity Analysis, Fatick Region

Variables	-30%	-20%	-10%	Base Case NPV	10%	20%	30%
Composting							
All benefits	15642	22062	28482	34902	41322	47742	54162
All costs	43692	40762	37832	34902	31972	29042	26112
Discount rate	52916	45570	39683	34902	30972	27705	24960
Live fences							
All benefits	128976	182949	236922	290895	344868	398841	452814
All costs	365547	340663	315779	290895	266011	241167	216283
Discount rate	612689	478283	373453	290895	225300	172762	130375
Field trees							
All benefits	14218	14971	15724	16477	17230	17983	18763
All costs	26857	23397	19937	16477	13017	9557	6097
Discount rate	37422	28548	21744	16477	12362	9122	6551
Rock dikes							
All benefits	-26272	-18806	-11340	-3874	3592	11058	18524
All costs	19685	11832	3979	-3874	-11727	-19580	-27433
Discount rate	17513	8598	1627	-3874	-8249	-11753	-14575
Woodlots							
All benefits	-16598	-7013	2572	12157	21742	31327	40912
All costs	37264	28895	20526	12157	3788	-4581	-12950
Discount rate	61488	40717	11354	12157	2292	-5544	-11808

4.0 Aggregation and Economic Analysis

4.1 Introduction

This section aggregates the results of the field interventions given the actual rates of adoption as verified by the KAPs ('92, '94, '96, and '98). The aggregation analysis of the different field interventions are based only on quantifiable benefits and costs, as such, it is only a partial economic analysis, not including other benefits and costs of a secondary and tertiary nature. It is reasonable to assume that implementation of the different NRM techniques will add considerably more in terms of secondary and tertiary values than the benefits and costs captured by the analytical spreadsheets developed for purposes of this study. These include: (a) the impacts on downstream agricultural productivity as a result of managing resources upstream, (b) the environmental benefits in terms of a higher incidence of flora and fauna biodiversity associated with improved NRM, and (c) the beneficial impact on women who spend less time collecting fuelwood as a result of planting and/or managing trees for fuelwood closer to the compound, or using improved cookstoves.

4.2 Assumptions

4.2.1 The SO2 Portfolio, Allocation of Funding Between NRM Techniques

The process of defining the parameters for the *ex-post* analysis is inexact at best. It is not possible to allocate the total amount of money spent (US contributions) among the different NRM technologies analyzed here, since they reflect but a fraction of the technologies supported by the different activities. According to the KAP'98, some 15 leading indicators (NRM technologies) and six supporting indicators were tracked and measured. Only six NRM technologies were analyzed in this report. Moreover, activities such as CBNRM, KAED, NRBAR, and PVO/NGO all extended other NRM techniques in addition to the 15 leading and six supporting indicators included in the KAP. The total amount spent over an average of 7.5 years of USAID support amounts to some \$81.3 million for the activities indicated in **Table 4.1**. Some support to Winrock and Rodale is included under the NRBAR activity, and Rodale received support from the PVO/NGO Support Project, the remainder of the USAID support for these two NGOs was provided by USAID/Washington and is not considered here. The SZWM Activity was not included in this analysis because the Team did not make any site visits, nor was this activity involved in the variety of different NRM technologies considered in the study except composting fairly capital intensive anti-salinization dikes.

The assumed time horizon for the aggregate analysis remains at 15 years. The USAID investments, however, will be spread evenly over only the first 7.5 years as indicated by the average duration of involvement by each SO2 Activity in **Table 4.1**. Moreover, the 15 years will, at least partially,

accommodate the staggering of different activities – they did not start and end on the same dates. CBNRM is the only activity still ongoing, the others have either ended or are in their final phases.

Table 4.1: SO2 Portfolio

SO2 Portfolio	US Contrib. \$US	No. years	Contrib./Year, US\$	Contrib./Year, FCFA
SRP, woodlots only	\$8,500,000	8.5	\$1,000,000	550,000,000
PVO/NGO	\$20,125,000	8.0	\$2,515,625	1,383,593,750
NRBAR	\$19,750,000	7.0	\$2,821,429	1,551,785,714
KAED	\$8,000,000	6.0	\$1,333,333	733,333,333
CBNRM	\$25,000,000	8.0	\$3,125,000	1,718,750,000
Total	\$81,370,000	7.5	\$10,795,387	5,937,462,798

Note: The assumed exchange rate is 550 FCFA = \$1 US

The next step is to state the assumptions on the allocation of the budgets among the six different NRM technologies analyzed. This obviously is the weakest link in the aggregate analysis because it is not possible to know how much of the time or money spent on each NRM technology in each activity. To do this in an exact fashion would entail revisiting the TORs for each LT staffer and ST consultant to estimate the relative weights of the investments made between each technology. For purposes of the analysis, it is assumed that PVO/NGO, NRBAR, KAED, and CBNRM are or were all involved with extending or promoting the full range of NRM techniques, not only the ones discussed here. The SRP Activity was involved with tree plantations and some improved fallow schemes. As indicated in **Table 4.2**, it is further assumed that each NRM technology is allocated five percent of the total budget; hence, an assumed 25 percent of the total budget is allocated between the five technologies discussed in this study (improved stoves excluded), leaving the remaining 75 percent divided between the other 15 or so technologies listed in the KAPs. A total of 1/3rd of the SRP budget is assumed to cover the woodlots of the kind of plantations envisioned in this study in only the two regions.

It is well recognized that the five-percent assumption across the board may generate some unavoidable disagreement – some will say it is too high, others that it is too low. An assumption, nevertheless, must be made to avoid the mistake of applying 100 percent of the total funding to the six technologies. To this end, the percentage budget allocation was included as a variable in the analytical framework developed for this study – other assumptions could be easily tested (and others are tested at end of this section). It is also assumed that the five percent allocation is based on the total budgets, not individual components of the SO2 activities. The activities, as designed, will typically have funding allocations for different components such as: training, technical assistance, special studies, administrative, and the like. All of these combined comprise the full budget for the activity from which the five percent is drawn. The five-percent allocation is also accounting for the fact that only two of the four regions covered by the KAPs are included in the analysis.

The allocation of the budgets between the regions is indicated on top of **Table 4.2**. As shown, it is assumed that 39 and 61 percent of the budgets are allocated between the Fatick and Kaolack regions, respectively. These percentages are simply based on the populations in the two regions as shown in **Table**

1.1 above. Thus, if the population in the two regions combined is 1,775,260, then the assumed budgetary allocation for the Fatick region is assumed to be 684,997 / 1,775,260, or 39 percent.³⁵

Table 4.2: Budget Allocation Between NRM Technologies

Technologies		Fatick	Kaolack
Allocation among regions		39%	61%
Composting			
SRP	0.0%	0	0
PVO/NGO	5.0%	26,693,484	42,486,203
NRBAR	5.0%	29,938,389	47,650,897
KAED	5.0%	14,148,099	22,518,567
CBNRM	5.0%	33,159,608	52,777,892
Total		103,939,580	165,433,559
Live Fences			
SRP	0.0%	0	0
PVO/NGO	5.0%	26,693,484	42,486,203
NRBAR	5.0%	29,938,389	47,650,897
KAED	5.0%	14,148,099	22,518,567
CBNRM	5.0%	33,159,608	52,777,892
Total		103,939,580	165,433,559
Field trees			
SRP	0.0%	0	0
PVO/NGO	5.0%	26,693,484	42,486,203
NRBAR	5.0%	29,938,389	47,650,897
KAED	5.0%	14,148,099	22,518,567
CBNRM	5.0%	33,159,608	52,777,892
Total		103,939,580	165,433,559
Rock dikes			
SRP	0.0%	0	0
PVO/NGO	5.0%	26,693,484	42,486,203
NRBAR	5.0%	29,938,389	47,650,897
KAED	5.0%	14,148,099	22,518,567
CBNRM	5.0%	33,159,608	52,777,892
Total		103,939,580	165,433,559
Woodlots			
SRP	33.0%	70,033,092	111,466,908
PVO/NGO	5.0%	26,693,484	42,486,203
NRBAR	5.0%	29,938,389	47,650,897
KAED	5.0%	14,148,099	22,518,567
CBNRM	5.0%	33,159,608	52,777,892
Total		173,972,672	276,900,468

³⁵ This assumption should have a fairly wide berth in its interpretation. Obviously, not all areas are equally suitable for the full range of interventions – some areas do not support Kad field trees, others do, some areas support live fences of the configurations assumed, others don't. What is important is that the KAP'98 results are taken into account, recognizing full and well that the field sites where the interventions are actually implemented may be different from the three regions (Fatick, Kaolack, and Thies) under study here.

4.2.2 Economic Assumptions

The partial *ex post* aggregate economic analysis reflects the USAID and GOS perspectives – what the donor investments bought. For purposes of the analysis, only the discount rate is shadow priced. The discount rate for risk-averse farmers must be relatively high to capture the risk factor as was argued in **Sections 2 and 3** above. It must be clearly demonstrated to the intended beneficiaries that the improved technologies will have very attractive returns to convince them to adopt. The discount rate applicable in the aggregate, however, can be justifiably much lower because the GOS (and USAID) have much lower risk factors. A government will typically maintain a differentiated investment portfolio (unlike the individual farmers) and thus, can spread the risks. For this reason, a lower (15-percent) rate for the aggregate economic analysis is assumed as the perspective shifts from the farmers to the aggregate (the GOS) as indicated in **Table 4.3**.

Table 4.3: Economic Analysis Assumptions

Assumptions	Financial Analysis	Economic Analysis
Discount rate	30 %	15 %

4.2.3 Aggregation

The aggregation of the results in accordance with the adoption is summarized in **Table 4.4**. These are based on the just completed KAP '98 surveys which trace the evolution of the rates of adoption for the different technologies back to KAP '92 or '94. The assumptions are derived from the differences in adoption rates between the KAPs, i.e., 20 percent adoption in 1998 less a five percent adoption in 1992 equals a 15 percent difference which can legitimately be counted as a return on the investments made in promoting the technology.

Table 4.4: Aggregation

NRM Technologies	Fatick	Kaolack	Thies
Composting, adoption 7.1%			
Area covered (hectares)	9,869	23,608	8,861
No. of years with USAID support	7.5	7.5	7.5
Live Fences, adoption 12.3%			
Meters of live fence	1,263,819	2,011,535	1,535,434
No. of years with USAID support	7.5	7.5	7.5
Field Trees, adoption 29.6%			
Area covered (hectares)	41,144	98,420	36,941
No. of years with USAID support	7.5	7.5	7.5
Rock Dikes, adoption 13.5%			
Area covered (hectares)	18,765	44,888	16,848
No. of years with USAID support	7.5	7.5	7.5
Woodlots, adoption 13.8%			
Area covered (hectares)	19,113	45,719	16,160
No. of years with USAID support	7.5	7.5	7.5

For **composting**, KAP '98 indicated a 16.4 percent adoption rate for the regions supported by the SO2 portfolio. In 1994, the rate of adoption was measured at 9.3 percent. Thus, the difference between the two, 16.4 - 9.3 indicates a 7.1-percent change in adoption between 1994 and 1998. If the millet production area in the Fatick region is 139,000 hectares, therefore, 7.1 percent x 139,000 hectares = 9,869 hectares covered by compost as a result of the support for the composting technology. The adoption in Kaolack region is derived in a similar fashion.

For **live fences**, KAP '98 indicated a 18.3 percent adoption for all of the regions supported by the SO2 portfolio (18.3 in 1998 - 6.0 in 1994 = 12.3 percent change). The length (number of meters) of live fence installed in the Fatick area is derived in the following manner: a) of the total population in the region (684,997 people) it is assumed that 60 percent live rural farming communities where manioc plantations will grow, thus a total of 411,000 people; b) the number of people per household (HH) is estimated at eight individuals, thus 411,000 / 8 = 51,375 HHs; c) if each live fence enclosure requires 200 meters (as assumed), then the total distance of live fence installed is 51,375 HHs x 200 meters x 12.3 percent = 1,263,819 meters in the Fatick region.

For **field trees**, KAP '98 indicated a net adoption of 29.6 percent for all of the regions supported by the SO2 portfolio. In 1998, the rate adoption was measured at 42.6 percent, in 1994 it was 13 percent, or a difference of 29.6 percent. Thus, if the millet production area in the Fatick region is 139,000 hectares, therefore, 29.6 percent x 139,000 hectares = 41,144 hectares covered by field trees in a (presumably) optimal density as a result of the support for the technology. The adoption in the other regions is derived in a similar fashion.

For the **rock dikes**, KAP '98 indicated a net adoption of 13.5 percent for all of the regions, or 13.5 percent in 1998 versus zero percent in 1994, or a difference of the full 13.5 percent. As above, if the millet production area in the Fatick region is 139,000 hectares, therefore, 13.5 percent x 139,000 hectares = 18,765 hectares covered by rock dikes in a (presumably) optimal configuration as a result of the support for the technology. The adoption in the other regions is derived in a similar fashion.

As indicated in **Table 4.4**, the assumed time period needed to reach the targets for all of the technologies is 7.5 years, derived from the average USAID support for SO2 in **Table 4.1** above. The impact of reaching these targets (the documented adoption rates) will flatten out after 7.5 years because the analytical time horizon is 15 years. The aggregation process (of the volumes of commodities produced and the costs and benefits) simply consists of adding rows horizontally along diagonal matrices, as indicated in the example shown in **Table 4.5** – the aggregation of millet produced in the Fatick region under the composting technology (technical alternative no. 3). The analytical time horizon (15 years) is indicated in the top row and the 1st column. The targeted 9,869 hectares are divided into 1,316 hectares per year to be covered by compost for 7.5 years (assuming a linear adoption for the sake of simplicity)³⁶. The numbers in each column indicate the kilos of additional cereal produced in the aggregate (i.e., for 1,316 hectares each year), over and above the production level without composting. The first batch of hectares produces the higher crop yields in year 1, followed by the second batch beginning in year 2, and so on for the entire 10 years. The aggregated increased millet production (kilos) over the entire 15 years is derived by adding each column horizontally in order to obtain the totals along the rows. The last column shows this aggregate total in terms of **tons** of additional millet produced as a result of the implementing the composting intervention.

Table 4.5: Aggregation Methodology

Year s Ha	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total Kilos
1	221066															221066
2	234224	221066														455290
3	247054	234224	221066													702344
4	259563	247054	234224	221066												961907
5	271759	259563	247054	234224	221066											1233666
6	283650	271759	259563	247054	234224	221066										1517316
7	295245	283650	271759	259563	247054	234224	221066									1812561
8	306549	295245	283650	271759	259563	247054	234224	110533								2008577
9	317570	306549	295245	283650	271759	259563	247054	117112	0							2098502
10	328316	317570	306549	295245	283650	271759	259563	123527	0	0						2186179
11	338794	328316	317570	306549	295245	283650	271759	129781	0	0	0					2271665
12	349009	338794	328316	317570	306549	295245	283650	135880	0	0	0	0				2355013
13	358969	349009	338794	328316	317570	306549	295245	141825	0	0	0	0	0			2436277
14	368680	358969	349009	338794	328316	317570	306549	147622	0	0	0	0	0	0		2515510

³⁶ Not considered here is the "bonus" of adoption by way of the "over-the-fence" demonstration effect – farmers replicating technologies after observing neighboring farmers without direct contact with the extension workers. The demonstration effect can be substantial and cause the participation adoption rate to be exponential rather than linear.

15	378149	368680	358969	349009	338794	328316	317570	153274	0	0	0	0	0	0	0	2592762
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4.3 Results By Region and NRM Technology

The detailed aggregate economic results by the field interventions only, expressed in NPV and EIRR (economic internal rate of return) are summarized in **Table 4.6** and briefly discussed in the several subsections below.

Table 4.6: Aggregate Base Case Economic Results

Interventions	NPV		EIRR	
	Fatick	Kaolack	Fatick	Kaolack
Composting	-1,846,803	1,010,693,430	14.9%	48.6%
Live fence	4,325,043,484	7,405,852,188	45.0%	52.1%
Field trees				
Rock dikes				
Woodlots				
Improved stoves				

Note: NA means “not applicable.”

4.3.1 Composting

Three different results are derived from the aggregate composting analysis: a) additional volume of millet produced, b) impact on millet-self sufficiency, and c) the aggregate NPV with the revised discount rate assumption. The results are summarized in **Tables 4.7** and **4.8**. For the Fatick region, it is estimated that the additional millet production will have reached a total of some 2,000 tons by year eight, after the 7.5 years of project support. If the same farmers continue with the composting for another seven years (to year 15), then the production will continue to increase as indicated in the table, over and beyond the production level without any composting. In terms of impact on food self-sufficiency, however, this increased impact is insignificant. Based on the assumptions of: a) 0.66 kilos of cereal consumption per capita per day (**Table 2.4**), b) the cereal production in the region of 87,000 tons for the Fatick region from **Table 1.1**, and c) the population in the Fatick region of 685,000 people (from **Table 1.1**), the current production level of 87,000 tons contributes roughly 53 percent of the cereal self-sufficiency needs for the region (i.e., production level divided by the consumption level). Adding the new production to the total as a result of applying the composting technique means that the situation with respect to cereal self-sufficiency will only improve in the sense that the reductions in self-sufficiency will not be as steep as they would otherwise have been when accounting for the increases in population in the future, given the assumptions. By year 15, the level of self-sufficiency will have declined to 25.7 percent, down from the current level of 53.1 percent. In order to meet the 100 percent of the self-sufficiency requirement given the current level of cereal consumption with the composting technology alone, it is clear that the targeted area to be treated with compost must increase substantially beyond the 9,869 hectares assumed in the aggregation scenario. In fact, composting the entire millet production area in the region with two tons of compost per year would only translate into less than 50 percent of cereal self-sufficiency in year 15, all else being equal. It is obvious, therefore, that

composting alone cannot solve the problem particularly the least intensive technical alternative, it can only slow down the inevitable. Composting must be extended in combination with other, equally important technologies such as rock dikes where warranted and/or protection of field trees. The same analysis is also carried out for the other regions with similar results, as indicated in the results tables.

The NPVs for the more intensive composting technologies – alternative 2 – are strongly positive for both regions (725,310,580, and 3,425,912,296 FCFA for the Fatick and Kaolack regions, respectively), unlike the negative NPV for the least intensive base case alternative (-1,846,803). For alternative 3, the corresponding results are 1,328,977,702 and 5,470,904,427 FCFA for the Fatick and Kaolack regions, respectively. These extraordinary differences are attributable to the differences in differences in yields obtained as the more intensive technologies are applied and higher quality compost is produced. It was assumed in **Table 2.7** that composting in Fatick and Kaolack would generate crop yield increases of 141 and 155 percent, respectively. As was demonstrated in the financial analysis, however, the results are very sensitive to any changes in the crop yield assumptions.

Table 4.7: Aggregate Composting, Fatick

		Add Tons Millet	Tons Millet	Tons Millet	Millet Self	Aggregate	Aggregate	Aggregate
Year	Ha Devel.	Produced	Consumed/Yr	Produced/Yr	Sufficiency	Costs	Benefits	NCF/Year
1	1,316	221	165,016	87,600	53.2%	123,282,820	22,106,560	(101,176,260)
2	2,632	455	169,966	85,410	50.5%	132,757,060	45,528,987	(87,228,074)
3	3,948	702	175,065	83,275	48.0%	142,231,300	70,234,383	(71,996,917)
4	5,263	962	180,317	81,193	45.6%	151,705,540	96,190,676	(55,514,865)
5	6,579	1,234	185,727	79,163	43.3%	161,179,780	123,366,592	(37,813,189)
6	7,895	1,517	191,298	77,184	41.1%	170,654,020	151,731,640	(18,922,380)
7	9,211	1,813	197,037	75,254	39.1%	180,128,260	181,256,093	1,127,833
8	9,869	2,009	202,949	73,373	37.1%	75,991,300	200,857,685	124,866,385
9	9,869	2,099	209,037	71,539	35.2%	71,056,800	209,850,223	138,793,423
10	9,869	2,186	215,308	69,750	33.4%	71,056,800	218,617,948	147,561,148
11	9,869	2,272	221,767	68,006	31.7%	71,056,800	227,166,479	156,109,679
12	9,869	2,355	228,420	66,306	30.1%	71,056,800	235,501,297	164,444,497
13	9,869	2,436	235,273	64,649	28.5%	71,056,800	243,627,745	172,570,945
14	9,869	2,516	242,331	63,032	27.0%	71,056,800	251,551,031	180,494,231
15	9,869	2,593	249,601	61,457	25.7%	71,056,800	259,276,235	188,219,435
NPV								(1,846,803)
IRR								14.9%

Table 4.8: Aggregate Composting, Kaolack

		Addit. Tons Millet	Tons Millet	Tons Millet	Millet Self	Aggregate	Aggregate	Aggregate
Year	Ha Devel.	Produced	Cons./Yr	Produced/Yr	Sufficiency	Costs	Benefits	NCF/Year
1	3,148	8,100	262,644	267,700	105.0%	207,769,676	246,383,608	38,613,932
2	6,295	14,593	270,524	261,008	101.9%	239,088,959	496,741,146	257,652,186
3	9,443	21,188	278,639	254,482	98.9%	270,408,243	750,973,264	480,565,021
4	12,591	27,883	286,999	248,120	96.2%	301,727,526	1,008,983,099	707,255,573
5	15,738	34,674	295,609	241,917	93.6%	333,046,809	1,270,676,207	937,629,398
6	18,886	41,559	304,477	235,869	91.1%	364,366,093	1,535,960,507	1,171,594,415
7	22,034	47,317	313,611	229,973	88.4%	395,685,376	1,804,746,219	1,409,060,843
8	23,608	50,334	323,019	224,223	85.0%	240,403,042	1,953,754,004	1,713,350,962
9	23,608	51,411	332,710	218,618	81.2%	234,894,625	1,980,911,549	1,746,016,924
10	23,608	52,107	342,691	213,152	77.4%	234,894,625	2,007,390,156	1,772,495,531
11	23,608	52,785	352,972	207,823	73.8%	234,894,625	2,033,206,797	1,798,312,172
12	23,608	53,446	363,561	202,628	70.4%	234,894,625	2,058,378,022	1,823,483,397
13	23,608	54,090	374,468	197,562	67.2%	234,894,625	2,082,919,967	1,848,025,342
14	23,608	54,719	385,702	192,623	64.1%	234,894,625	2,106,848,363	1,871,953,738
15	23,608	34,015	397,273	187,808	55.8%	234,894,625	2,130,178,549	1,895,283,924
NPV								5,470,904,427
IRR								NA

4.3.2 Live Fences

As indicated in **Table 4.6**, the live fence coverage in the Fatick and Kaolack regions are financially very attractive from the perspective of the participant farmers as evidenced by the strong positive NPVs and EIRRs (see **Tables 4.9** and **4.10**). It is important to note, however, that the SO2 activities may promote (or promoted) different live fences configurations and species from those analyzed in this study. It is suspected that the live fence configuration promoted the most over the years is the salane fence because it is effective in protecting areas against livestock intrusion. The salane fence is not financially feasible, however, as indicated in **Section 3**. The important finding, however, is that farmers now have a greater propensity to adopt live fences than they did before (18.3 percent in 1998 as opposed to six percent in 1994). The technology has a market and the trend upward should continue. The challenge now is to promote live fences also from the perspective of the value harbored in the fences themselves, in addition to the crops they intend to protect.

The estimated 1.2 and 2.0 million meters of fence installed in the Fatick and Kaolack regions, respectively, translate into 6,319 and 10,058 live fence enclosures in the two regions. This is based on the assumed standard configuration of 200 meters of fence per enclosure, covering approximately 1/4th of one hectare each. The 12.3 percent increase in adoption between 1992 and 1998 would indicate that about 6,319 new live fence enclosures were built in the Fatick region during this period (based on the assumptions presented earlier). Lacking data on these enclosures, it is assumed here that, on the average, each encloses 1/4 hectare using 200 m of live fence. Thus, $6,319 \times 200 = 1.2$ million meters of live fence. The impact on farmer incomes could be substantial. These enclosures would generate not only revenues from the

additional manioc produced, but much more importantly, from the perimeter fence in the form of the production and sale of the highly valued Acacia seeds, fuelwood, and poles.

In addition to the 30,000 tons of manioc produced per year (production gradually increases to this level over the 7.5 years)³⁷ as indicated in **Table 4.9** for the Fatick region, the live fences of the assumed configuration would also have generated more than 5,000 m³ of additional fuelwood and more than 6,000 m³ of additional poles beginning in year 11. Nearly 2,000 tons of high value seeds would be produced per year in the aggregate with the intervention, beginning in year 6, increasing to 14,000 tons by year 15. All of these products have commercial value and the participating farmers could have substantially increased their incomes if, in fact, the live fence configuration assumed in the analysis were the same as those actually promoted in the field through the SO2 activities. Any of the live fence configurations actually promoted would be associated with only slightly positive or negative NPVs.

Table 4.9: Aggregate Live Fences, Fatick

Year	Meters of Live fence	Tons Manioc Produced	Tons Manioc Leaves Prod.	m3 of FW Produced	m3 of Poles Produced	Tons Seeds Production	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	224679	0	0	0	0	0	294130330	0	-294130330
2	449358	4494	0	0	0	0	362882096	67403692	-295478404
3	674037	8987	0	0	0	0	411412754	68751765	-342660988
4	898716	13481	0	674	899	0	459943412	146715369	-313228043
5	1123395	17974	0	1348	1797	0	508474070	606633225	98159155
6	1348074	22468	0	2022	2696	1797	557004728	1133954773	576950045
7	1572753	26961	0	2696	3595	3595	605535386	1593872629	988337243
8	1685092	31455	0	3370	4494	5392	455031088	2121194176	1666163088
9	1685092	33702	0	4044	5392	7190	374090489	2547410187	2173319698
10	1685092	33702	0	4718	6291	8987	363979935	3040355851	2676375917
11	1685092	33702	0	5055	6740	10785	363979935	3460617869	3096637934
12	1685092	33702	0	5055	6740	12582	363979935	3718998687	3355018752
13	1685092	33702	0	5055	6740	13481	363979935	3685296841	3321316906
14	1685092	33702	0	5055	6740	13481	363979935	3718998687	3355018752
15	1685092	33702	0	5055	6740	13481	363979935	3685296841	3321316906
NPV									4325043484
IRR									45.0%

³⁷ It should be clearly understood that manioc production inside the closures is but one of many possibilities. Some farmers may produce vegetables, other improved millet seeds, yet other a host of different crops. The analysis was based on manioc because this was the crop most frequently observed by the team inside live fence enclosures during field visits. Similar analysis should be carried out using different crops and/or combination of crops.

Table 4.10: Aggregate Live Fences, Kaolack

Year	Meters of Live fence	Tons Manioc Produced	Tons Manioc Leaves Prod.	m3 of FW Produced	m3 of Poles Produced	Tons Other Production	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	357606	0	0	0	0	0	361357076	0	-361357076
2	715212	7152	0	0	0	0	454766060	107281871	-347484189
3	1072819	14304	0	0	0	0	532009007	109427508	-422581499
4	1430425	21456	0	1073	1788	0	609251954	233516872	-375735082
5	1788031	28608	0	2146	3576	0	686494901	965536837	279041936
6	2145637	35761	0	3218	5364	2861	763737847	1804838672	1041100825
7	2503244	42913	0	4291	7152	5722	840980794	2536858637	1695877842
8	2682047	50065	0	5364	8940	8583	654828424	3376160472	2721332049
9	2682047	53641	0	6437	10728	11443	587405120	4054539502	3467134381
10	2682047	53641	0	7510	12516	14304	579322102	4839127583	4259805481
11	2682047	53641	0	8046	13410	17165	579322102	5508030047	4928707945
12	2682047	53641	0	8046	13410	20026	579322102	5919277218	5339955116
13	2682047	53641	0	8046	13410	21456	579322102	5865636283	5286314181
14	2682047	53641	0	8046	13410	21456	579322102	5919277218	5339955116
15	2682047	53641	0	8046	13410	21456	579322102	5865636283	5286314181
NPV									7405852188
IRR									52.1%

4.3.3 Field Trees

The aggregate partial economic analysis for the field trees intervention also shows positive NPVs and EIRRs higher than the assumed opportunity cost of capital of 15 percent for both regions, as indicated in **Table 4.6**. The detailed results are presented in **Tables 4.11** and **4.12**. In terms of additional impact on food production (millet), the estimated 41,144 hectares with Kad trees in the Fatick region will generate an incremental increase in the supply of millet of more than 39 tons in year 4, increasing to more than 3,660 tons per year in year 15 over and beyond the production level without the field trees. As with the composting intervention, however, this additional increase in the supply of millet will not have a significant impact on the cereal self sufficiency in the region given the rapid increases in population, unless the targets for field tree coverage are also increased dramatically. The supply of fuelwood in the aggregate will also increase incrementally, from 1,728 m³ to more than 17,000 m³ in year 15 in the Fatick region.

Table 4.11: Aggregate Field Trees, Fatick

Year	Tons Addit. Ha Devel.	m3 of FW Millet Prod.	Tons of Pods & Leaves Prod.	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	5486	0	0	140102413	0	-140102413
2	10972	0	0	176265247	0	-176265247
3	16458	0	0	212428080	0	-212428080
4	21943	39	864	248590913	73071744	-175519169
5	27429	118	1728	249644199	167209216	-82434983
6	32915	217	3538	250697485	267271424	16573939
7	38401	415	5431	251750772	381158016	129407244
8	41144	711	7406	130783061	508868992	378085931
9	41144	1047	9463	95673515	644479616	548806101
10	41144	1422	11603	60563968	787989888	727425920
11	41144	1837	13824	25454421	904838848	879384427
12	41144	2271	15264	7899648	984493632	976593984
13	41144	2775	15882	7899648	1064477568	1056577920
14	41144	3259	16499	7899648	1142486592	1134586944
15	41144	3663	17116	7899648	1212595968	1204696320
NPV						830775217
IRR						28.4%

Table 4.12: Aggregate Field Trees, Kaolack

Year	Tons Addit. Ha Devel.	m3 of FW Millet Prod.	Tons of Pods & Leaves Prod.	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	13123	0	0	252568066	0	-252568066
2	26245	0	0	339702573	0	-339702573
3	39368	0	0	426837079	0	-426837079
4	52491	118	2067	513971586	197824200	-316147386
5	65613	354	4134	517121026	449385720	-67735306
6	78736	650	6496	520270466	717284960	197014494
7	91859	1240	8858	523419906	1025142720	501722814
8	98420	2126	11318	317568533	1372959000	1055390467
9	98420	3130	13877	233583467	1743018200	1509434733
10	98420	4252	16535	149598400	2135320320	1985721920
11	98420	5492	18257	65613333	2456858460	2391245127
12	98420	6791	18995	23620800	2680763960	2657143160
13	98420	8297	19733	23620800	2909590460	2885969660
14	98420	9744	20471	23620800	3132511760	3108890960
15	98420	10954	21210	23620800	3331812260	3308191460
NPV						18197734384
IRR						35.9%

4.3.4 Rock Dikes

The aggregate analysis for the rock dikes intervention shows a slightly negative aggregate NPVs and EIRRs lower than the assumed opportunity cost of capital for the Fatick region. The reason for the poor performance is traced back to the assumed lower crop yield increases in that region versus the yield

increases expected in Kaolack. The detailed results are presented in **Tables 4.13** and **4.14**. In terms of additional impact on food production (millet), the 18,765 hectare target in the Fatick region will generate an incremental increase in the aggregate supply of millet of more than 500 tons in year 1, increasing to more than 5,500 tons per year in year 15. As above, however, this additional increase in the supply of millet will not have a significant impact on the cereal self-sufficiency in the region given the rapid increases in population, unless the targets for rock dike coverage are also increased dramatically.

Table 4.13: Aggregate Rock Dikes, Fatick

Year	Ha Devel.	Tons Addit. Millet Prod.	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	2,502	500	326,867,780	50,040,000	(276,827,780)
2	5,004	1,026	336,875,780	102,582,000	(234,293,780)
3	7,506	1,576	346,883,780	157,563,450	(189,320,330)
4	10,008	2,149	356,891,780	214,923,364	(141,968,417)
5	12,510	2,746	366,899,780	274,602,280	(92,297,501)
6	15,012	3,365	376,907,780	336,542,223	(40,365,558)
7	17,514	4,007	386,915,780	400,686,667	13,770,887
8	18,765	4,420	181,520,100	441,960,500	260,440,400
9	18,765	4,591	75,060,000	459,058,988	383,998,988
10	18,765	4,757	75,060,000	475,730,013	400,670,013
11	18,765	4,920	75,060,000	491,984,263	416,924,263
12	18,765	5,078	75,060,000	507,832,156	432,772,156
13	18,765	5,233	75,060,000	523,283,852	448,223,852
14	18,765	5,383	75,060,000	538,349,256	463,289,256
15	18,765	5,530	75,060,000	553,038,025	477,978,025
NPV					(20,790,508)
IRR					14.6%

Table 4.14: Aggregate Rock Dikes, Kaolack

Year	Ha Devel.	Tons Addit. Millet Prod.	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	5,985	1,646	698,697,059	164,587,500	(534,109,559)
2	11,970	3,367	722,637,059	336,656,250	(385,980,809)
3	17,955	5,160	746,577,059	516,019,219	(230,557,841)
4	23,940	7,025	770,517,059	702,494,051	(68,023,009)
5	29,925	8,959	794,457,059	895,902,950	101,445,890
6	35,910	10,961	818,397,059	1,096,072,563	277,675,504
7	41,895	13,028	842,337,059	1,302,833,874	460,496,815
8	44,888	14,337	434,211,750	1,433,728,340	999,516,590
9	44,888	14,849	179,550,000	1,484,854,663	1,305,304,663
10	44,888	15,347	179,550,000	1,534,702,827	1,355,152,827
11	44,888	15,833	179,550,000	1,583,304,788	1,403,754,788
12	44,888	16,307	179,550,000	1,630,691,699	1,451,141,699
13	44,888	16,769	179,550,000	1,676,893,938	1,497,343,938
14	44,888	17,219	179,550,000	1,721,941,121	1,542,391,121
15	44,888	17,659	179,550,000	1,765,862,124	1,586,312,124
NPV					1,658,828,709
IRR					29.9%

4.3.5 Woodlots

The woodlot intervention is also economically feasible in the aggregate in both regions given the assumptions. The detailed results are presented in **Tables 4.15** and **4.16**. It is important to note that different technical woodlot configurations consisting of different species mixes linked closely to strong market opportunities should be tested; and, equally important, considering technical wood growing alternatives that deviate from traditional forestry practices. Of particular interest here, for example, is to consider *Acacia leatea* woodlots (the live fence species) and the like instead of only planting these trees in a live fence configuration, given the very attractive results obtained from the live fence analysis.

In terms of additional wood produced over the time period analyzed, the aggregate intervention is estimated to have produced nearly 2,700 m³ of fuelwood in year 5 increasing to 6,422 m³ in year 15, and poles from 15,163 m³ to 36,390 m³ over the same time period in the Fatick region. In this context, it is noteworthy to mention that woodlots are, more often than not, promoted in order to increase the production of fuelwood. The real reason why farmers may consider the woodlots, however, is to produce cash crops of poles which fetch much higher prices in the market than fuelwood. Once having extracted the poles, the residual volume could be sold or consumed as fuelwood.

Table 4.15: Aggregate Woodlots, Fatick

Year	Ha Devel.	m3 of FW Produced	m3 of Poles Produced	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	2,548	0	0	193,036,250	0	-193036250
2	5,097	0	0	236,803,875	0	-236803875
3	7,645	0	0	257,190,542	0	-257190542
4	10,193	0	0	277,577,208	0	-277577208
5	12,742	2676	15163	297,963,875	643071917	345108042
6	15,290	2676	15163	318,350,542	643071917	324721375
7	17,838	2676	15163	338,737,208	643071917	304334708
8	19,113	2676	15163	262,605,750	643071917	380466167
9	19,113	2676	15163	164,590,479	643071917	478481438
10	19,113	5887	33358	152,900,000	1414758217	1261858217
11	19,113	5887	33358	152,900,000	1414758217	1261858217
12	19,113	4549	25776	152,900,000	1093222258	940322258
13	19,113	3211	18195	152,900,000	771686300	618786300
14	19,113	3211	18195	152,900,000	771686300	618786300
15	19,113	6422	36390	152,900,000	1543372600	1390472600
NPV						1129834360
IRR						32.4%

Table 4.16: Aggregate Woodlots, Kaolack

Year	Ha Devel.	m3 of FW Produced	m3 of Poles Produced	Aggregate Costs	Aggregate Benefits	Aggregate NCF/Year
1	6,096	0	0	461,759,375	0	-461759375
2	12,192	0	0	566,455,313	0	-566455313
3	18,288	0	0	615,221,979	0	-615221979
4	24,383	0	0	663,988,646	0	-663988646
5	30,479	7315	41452	712,755,313	1758038333	1045283021
6	36,575	7315	41452	761,521,979	1758038333	996516354
7	42,671	7315	41452	810,288,646	1758038333	947749687
8	45,719	7315	41452	628,175,625	1758038333	1129862708
9	45,719	7315	41452	393,714,635	1758038333	1364323698
10	45,719	16239	92023	365,750,000	3902845100	3537095100
11	45,719	16239	92023	365,750,000	3902845100	3537095100
12	45,719	12582	71297	365,750,000	3023825933	2658075933
13	45,719	8924	50571	365,750,000	2144806767	1779056767
14	45,719	8924	50571	365,750,000	2144806767	1779056767
15	45,719	17849	101142	365,750,000	4289613533	3923863533
NPV						3604181796
IRR						36.7%

4.3.6 Improved Stoves

Finally, the aggregate results for the improved stoves are summarized in **Table 4.17**. As indicated, and given the assumptions listed in **Table 2.17** including that only 70, 75 and 85 percent of the households in the Fatick, Kaolack, and Thies regions respectively will adopt and use the stoves. If so, a considerable amount of wood will be saved each year, of the order of 13,000 m³ in Fatick, 25,000 m³ in Kaolack, and nearly 23,000 m³ in the Thies region. More significantly, however, women will save time valued at 328 million FCFA in the Fatick region, 490 million FCFA in the Kaolack region, and 450 million FCFA in the Thies region. This additional income could be in the form of more time spent on “petit commerce” by the women, or they could devote more time pursuing other income-generating opportunities.

Table 4.17: Improved Woodstoves, Aggregate Results

Results in the Aggregate	Fatick	Kaolack
Wood saving per region (kilos/year)	8,446,743	16,546,593
Wood saving per region (m3/year)	12,995	25,456
Time saving per region (hours/year)	2,461,172	3,679,637
Value of time saved per year, opportunity cost (FCFA)	246,117,233	367,963,733

4.4 Results: Global SO2 Support of Five Technologies

The answer to the fundamental question: were USAID’s investments in NRM support to SO2 economically feasible? – is provided in the summary table below, **Table 4.18**. The table adds all of the aggregate net cash flows for the technologies given the assumptions, to obtain an overview of the total economic feasibility

of the activities undertaken under the auspices of the activities in the SO2 portfolio. The first total column reflects the base case where the five-percent allocation of the budget is invoked (i.e., five percent of the total funding level for each activity is allocated to each of the technologies for a total of 25 percent budgetary allocation for the five technologies combined). The 38.4 percent EIRR result indicates a strong economic feasibility. If the budgetary allocation were doubled to 10 percent (i.e., a 50 percent budgetary allocation for the five technologies combined), the EIRR would only reduce to 30.9 percent, still a strongly feasible result. In the last column, the budgetary allocation is increased yet another time – to 15 percent. The result is still strongly positive as indicated by the 25.7 percent EIRR, well above the assumed 15-percent aggregate opportunity cost of capital.

It can be concluded, therefore, that USAID's investments in NRM over time have been strongly economically feasible with the one major caveat that the configurations of the technologies extended or supported may have been different from those analyzed here. The live fence technology, in particular, falls into this category. Although the fence configuration usually extended (the salane fence) was shown to be not economically feasible, the important fact to retain is that USAID's support has been instrumental in integrating live fences as a viable concept among the local farming communities. As such, farmers now have a higher propensity to adopt live fences as a means to increase crop production and incomes. In turn, these communities have become much better candidates for the promotion of live fences of the kinds of configurations presented in the base case in this study.

Table 4.18: NPV Results, Global SO2 Support

Year	Aggregate Net Cash Flows					Total		
	Compostin g	Live Fences	Field Trees	Rock Dikes	Woodlots	5%	10%	15%
1	-375741171	-923973577	-511512689	-897584550	-867350825	-3576162812	-4997552850	-6418942888
2	-333388677	-916362149	-667677869	-687152400	-1072957188	-3677538282	-5098928321	-6520318359
3	-285916994	-1065460939	-823843049	-466986581	-1175057721	-3817265284	-5238655322	-6660045361
4	-233454102	-959445358	-642007901	-237330435	-1262515054	-3334752850	-4756142889	-6177532927
5	-176124782	909289679	-214341062	1578780	1628514663	2148917277	727527239	-693862800
6	-114050693	2998773268	241656469	249509736	1541057329	4916946110	3495556071	2074166033
7	-47350456	4867508305	767592821	506236892	1453599996	7547587558	6126197520	4704807481
8	389404617	7596652437	1796898093	1398006370	1799818075	12980779593	12980779593	12980779593
9	454033667	9745894794	2587671171	1837574151	2248839335	16874013117	16874013117	16874013117
10	489017833	11906122065	3417176973	1904093340	5913033141	23629443352	23629443352	23629443352
11	523127396	13796398706	4126817368	1968949551	5920354741	26335647761	26335647761	26335647761
12	556384219	14898506986	4593676510	2032184356	4431111216	26511863287	26511863287	26511863287
13	588809622	14788132710	4993393282	2093838291	2941867691	25406041595	25406041595	25406041595
14	620424389	14898506986	5382708022	2153950877	2941867691	25997457965	25997457965	25997457965
15	651248788	14788132710	5730414634	2212560649	6539665381	29922022163	29922022163	29922022163
NPV						32701996917	26788417751	20874838586
EIRR						38.4%	30.9%	25.7%

5.0 Recommendations

5.1 Introduction

Several recommendations pertaining to each NRM technology are presented in this section. To set the stage, all of the analytical results presented are based on the fundamental assumption that no subsidies and/or direct financial incentives are made available for the intended beneficiaries. As such, the results reflect the net benefits of the interventions only on their own merit. Although this is largely inconsistent with USAID's mode of operation through the CBNRM Activity (and other activities) where subsidies form an integral part of the strategy to attract adoption, it is essential to confirm or reject the technologies on their own merit to ensure the sustainability of the interventions beyond the donor support. As stated in the Limited Assessment report (1998), there are differences of opinions regarding the extent to which subsidies (i.e., matching grants) are needed in order to have a discernible and sustainable impact in the field in terms of crop yield increases and eventual progress towards food security in the long run.

5.2 Recommendations

5.2.1 General

CBNRM is the only major NRM activity left in USAID's portfolio and, thus, offers the only real opportunity to address NRM in a meaningful way. Over the past several years, however, CBNRM has been implemented on the basis of essentially paying participants in-kind (with equipment and supplies, etc.) to adopt the proposed technologies through the vehicle of matching grants. Once the parties have agreed on what to do and how to do it, the issue of matching the costs (project vs. implementor) is negotiated and implementation proceeds. This system will potentially work well, although the sustainability in the long run of this approach is highly suspect. It is unclear, at best, whether farmers will opt to implement similar activities without any project support in the future.

Perhaps the best evidence available to date to the contrary is KAED – several *NRM field activities* promoted through this project with subsidies are not continuing today, only a few months after closure of the activity, despite how well it demonstrated the physical benefits of the techniques. Some non-NRM activities, however, are continuing to some degree (local credit systems, etc.). In many other ways, however, KAED contributed positively as well documented in the Limited Assessment report (1998) and its rejuvenation with a different and much more economically oriented design should be considered. As far as CBNRM is concerned, it is strongly recommended that the Activity revisits how matching grants are applied. Since all of the NRM technologies investigated in this study are judged reasonably financially attractive on their own merit, all else being equal, farmers would be financially better off with the interventions than without them. As such, they would, by definition, be able to repay the loans needed to make the initial investments. If legally possible, the project funds allocated for the matching grants could,

instead, be used to provide some form of credit for adopting the technologies if credit is not sufficiently available through CNCAS or other credit institutions. The key factor is to inform the intended beneficiaries about the *income-generating* opportunities available through the adoption of different NRM techniques, not only in terms of higher crop yields, but also in terms of actual FCFA incomes generated through the implementation of different technical configurations of the same techniques. CBNRM, therefore, should not automatically (as a matter of formal routine) offer matching grants in the technical packages, but instead make the judgement only after the farmer-perspective financial attractiveness of the NRM techniques has been clearly documented.

Although the technologies analyzed are financially feasible, the question still remains whether the interventions are the best ones among several other options. Instead of composting, protecting field trees, building rock dikes, etc. (all feasible), farmers may prefer to invest in other interventions, particularly value-added interventions such as cattle fattening, grain mills, supply stores, and other possibilities for which the financial feasibility is yet to be determined. Because KAED successfully promoted such enterprises as well, the project may have been a “non-NRM” success story, more so than the project’s involvement in promoting NRM activities.

5.2.2 Composting

- USAID should continue to extend, through CBNRM or other activities present and future, the technique of composting in view of its demonstrated financial attractiveness to participating farmers. To the extent possible, composting should be promoted in combination with the application of phosphates and improved millet seeds as indicated by the much stronger financial results. A necessary condition for this kind of composting to be successful is that the phosphates and improved seeds are available in ample supplies.
- The secondary recommendation for the composting technology is for USAID to promote, perhaps through the SO1 portfolio, a private sector initiative to produce and sell essential farm inputs such as phosphates and improved millet seeds
- Composting should be carried out during the rainy season to minimize the need for watering, or using scarce water that otherwise has a high opportunity cost.
- The extension of the technology should include detailed demonstration of the differences between cement pit and above-the-ground composting in terms of the physical impacts on crop yields and the investment burdens associated with both. These differences could also be highlighted in video presentations where the main bottom-line focus should be on farmer incomes. The purpose for highlighting the differences is to ensure that farmers clearly understand the tradeoffs involved between the cement pits and clay pit or above-the-ground composting.

5.2.3 Live Fences

- USAID should continue to extend, through CBNRM or other activities present and future, the technique of live fences other than the salane fence in view of the demonstrated very strong financial attractiveness to participating farmers. The salane fences so common throughout the farm landscape in Senegal should be encouraged only in combination with the more valuable thorny species as discussed in this report.
- The promotion of the live fences should clearly distinguish between the costs and benefits of the live fence itself, and the costs and benefits associated with the crops it protects – the perimeter fence versus the enclosed protected area. In the past, live fences have been promoted as a means to an end – to protect cash (or other) crops against livestock intrusion. Based on the very strong feasibility results, however, it is clear that the perimeter fence is potentially far more commercially valuable than the crops protected inside the enclosures. In the long run, therefore, this may translate into a willingness of some farmers to shift their factors of production into more economically efficient production schemes, such as transforming the fence species into full-fledged woodlot configurations to take advantage of the strong markets for the products (such as the seeds from the *Acacia leatea* trees).
- The promotion of live fences should be prioritized for physical demonstration and perhaps video production where the differences in the potential for generating incomes should be highlighted. Also highlighted in the video presentation should be the salane fence where the focus should be on what farmers give up by opting for this configuration rather than the other configurations featured in this study.

5.2.4 Field Trees

- USAID should continue to extend, through CBNRM or other activities present and future, the technique of field trees (Kad protection) in view of the financial attractiveness to participating farmers (even the marginally financially attractive results obtained). The reason for this recommendation is that Kad protection is already part of the farming culture and tradition in Senegal – the farmers are already aware of and appreciate the beneficial effects of the presence of Kad trees in the farm landscape.
- To the extent possible, protection of field trees should be done in combination with other technologies on the same farm fields, notably composting and/or rock dikes.
- The protection of field trees could also be a subject matter for video presentation, highlighting the different protection methods – from piling the thorn bushes around each seedling (and the associated labor required for such operations) to the iron baskets that require cash investments up front.

5.2.5 Rock Dikes

- USAID should continue to extend, through CBNRM or other activities present and future, the technique of stemming water erosion by constructing rock dikes along the contours in farm fields prone to such erosion in view of the strong financial attractiveness to participating farmers.
- The rock dike technique should be strongly promoted in areas where ample supplies of nearby rocks can be easily mined. In other areas prone to heavy water erosion but with no nearby source of rocks, the same technique should be promoted through a judicious application of matching grants calibrated to the results of the financial analysis of the intervention in those areas. For example, if a 20-percent subsidy is needed to attain financial feasibility of a rock dike intervention in an area, then the matching grant should reflect this magnitude, not exceeding this amount. It is also recommended that other anti-erosion techniques be included in the portfolios of services rendered such as bands of vetiver grass and others.

5.2.6 Woodlots

- USAID should continue to extend, through CBNRM or other activities present and future, the planting of woodlots by individual farmers. The technique should only be promoted on the basis of a firm understanding of the markets for the wood, particularly poles (and perhaps sawlogs) or other products depending on the species. Currently, the market for poles is strong, hence, the plantation of *short rotation* species in response to this market may be in order. Short rotation here means that farmers should be well informed about the difference between financial and biological maturity of the trees. The former responds to maximization of income and almost always occurs much earlier during the life of the stand, the latter to the maximization of wood production. Farmers should receive the information on marketing opportunities as they occur.
- The extension of woodlots should not necessarily adhere strictly to traditional forestry principles, such as 4 x 4 meter spacing, two thinning regimes, and harvesting at biological maturity at age 15. Such is the typical advice given by forestry extension workers trained in traditional forestry techniques. The advice given should, instead, be in the context of market opportunities. Recently in Ethiopia, for example, some enterprising farmers decided to abandon traditional forestry techniques and planted eucalyptus trees in very tight spacing (0.30 by 0.30 meters - 111,000 trees per hectare) and clearcut harvesting long, straight and thin poles every two years in response to a very strong housing construction market in and near urban centers. The poles are used inside plastered walls. Similar scenarios could be investigated on behalf of Senegalese farmers in response to specific niche (or extensive) markets, including strategic fuelwood production on a very short rotation basis.

- It is recommended that different woodlot configurations using different species combinations and technical options are investigated with a view to determining the extent to which each increases farmer incomes.

5.2.7 Improved Stoves

USAID should continue to extend, through CBNRM or other activities present and future, the adoption of improved woodstoves throughout Senegal. The major constraint to adoption is the need for training on how to build and operate the stoves.

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Annex D.

Contribution to Usaid/senegal Life-of-strategic Objective Assessment of the Impact of Natural Resource Management Activities

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February 16, 1999

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1.0 Introduction

This report contributes to the USAID/Senegal life-of-strategic objective assessment of the impact of the seven agriculture and natural resource activities under strategic objective 2 (SO2) in the period 1992-1998. Since 1962, USAID has supported programs in natural resource management in Senegal, however, it recently terminated its environmental SO2, “Increased crop productivity through improved natural resources management in zones of reliable rainfall.” For the period 1998-2006, the mission has recast SO2 as “More effective, democratic, and accountable local management of services and resources in targeted areas.”

The majority of this report analyzes the Projet de Reboisement du Sénégal (Senegal Reforestation Project (SRP)), based mainly on field work in November and December 1998. Following that, the report provides observations on the follow up project to SRP, the Community Based Natural Resource Management (CBNRM) project, on the USGS EROS Data Center environmental monitoring effort, and on the 1998 Knowledge, Attitudes, and Practices Survey.

1.1 Senegal Reforestation Project

Project description. The Senegal Reforestation Project (SRP), USAID no. 685-0283, officially operated from December 18, 1987 to March 31 1995. Through USAID, the Government of Senegal signed a host country contract with the Southeast Consortium for International Development (SECID). Virginia Polytechnic Institute and State University served as lead institution and Louis Berger International, Inc. served as subcontractor. Originally allocated \$10 million for an original project completion date of September 30, 1993, USAID/Senegal eventually increased total obligations to \$14 million and extended the project to March 31, 1995. Senegalese government officials from the Direction des Eaux, Forêts, Chasses et de la Conservation des Sols (Senegal Forest Service) formed the majority of the project staff, with Americans serving in three permanent positions and as short-term consultants.

The project consisted of the six components listed in Table 1. Activities covered the entire country. Over an eight year period, the project produced the quantitative results listed in Table 2.

Methods. Because the matching grant component was the significant field activity of SRP, the present assessment concentrated on an assessment of the long-term status of matching grant plantations. The USAID/Senegal mission file only contained the list of matching grant plantations from 1988 while the mission library only had the list of plantations from 1992, so these formed the basis for a stratified random sample. The sample covered the five central regions of the country, Diourbel, Fatick, Kaolack, Louga, and Thiès. These regions contain the majority of the nation’s population and form the Peanut Basin, an agricultural area that

Table 1. Components of the Senegal Reforestation Project.

Matching grants	Signed contracts with individuals and groups that gave cash payments for plantations that maintained a 45% survival rate at the end of nine months.
Roadside planting	Signed contracts with small enterprises that paid the establishment costs of plantings along roads in urban areas.
Private sector	Wrote marketing studies and much of the text of the new Senegal Forest Code
Training	Sent Senegalese personnel for study and conferences in the U.S. and third countries. Hosted local training seminars for Senegalese.
Media	Promoted project activities on television, radio, and in the newspapers. Conducted other public relations activities that distributed posters, T-shirts, and other promotional items
Test program	Composed resource management plans for three communautés rurales in preparation for the follow-up project, CBNRM.

Table 2. Quantitative results of the Senegal Reforestation Project (n.r. = nor reported).

component	result	1988	1989	1990	1991	1992	1993	1994	total
matching grants	grants	48	244	350	611	744	948	0	2945
	hectares	60	376	455	818	974	1106	0	3789
roadside planting	km	20.2	9.9	14.5	41.6	49	0	0	135
	trees	4667	1494	3192	8717	12 684	0	0	30 754
private sector	studies	1	2	3	5	0	1	4	16
training	people	62	107	144	320	275	212	236	1356
	person-months	15.5	84.3	133	238.3	122.5	70.5	46.3	710
media	productions	24	29	17	89	69	50	41	319
test program	grants						93	n.r.	93
	hectares						85	n.r.	85
construction	office building	1							1
short-term tech. asst.	consultancies	8	9	9	11	4	1	3	45
	person-months	10	11	10	13	9	3	4	60

traditionally has dominated the Senegal economy. The sample could not include other regions due to security concerns and lack of funds.

Within the list of plantations for each region, I used computer-generated random numbers to select two plantations, one from 1988 and one from 1992, that had achieved a nine-month survival rate of at least 45%, gaining a cash payment from SRP. Because of my long field experience in the Région de Louga, in that region I chose two sites in villages that I had never visited.

At each plantation, I counted all live trees, inspected tree growth, and examined signs of ecological impact. In addition, I conducted a semi-structured interview with the person who planted the trees or led the group that planted the trees. We discussed the socio-economic impacts of the activity and the cash payment that the project had given.

For the other project components, I mainly reviewed available project documents. In addition, long discussions with CBNRM staff provided additional insights into the SRP test program component that served as a transition to the CBNRM. The CBNRM staff interviewed included Massamba Diop (Chef de Division Études et Recherches), Kent Elbow (technical advisor in natural resources planning), Keith Moore (consultant on indicators from Virginia Tech), and Papa Sarr (Chef de Division Aménagement et Gestion des Terroirs and former SRP private sector coordinator).

Results. The average long-term survival rate fell from the average nine-month survival rate an average of 24%, as shown in Table 3, from 59% to 36%. Survival rates of the 1988 plantations fell farther (from 55% to 26%) than the 1992 plantations (68% to 57%). Plantations in the Region de Diourbel showed the worst survival, probably due to a combination of more arid conditions and higher population density. Survival rates in the southernmost, and hence, the moistest sites, Kër Alfa and Kër Useynu Jeng, did not change.

Table 3. Plantation survival results, sorted by region, then by year.

							9 month		1998		
village	<i>Communaute Rurale</i>	Région	project	year	main species	tree planted	trees surviving	survival rate	trees surviving	survival rate	rate difference
Ñangeen	Ndulo	Diourbel	none	1988	<i>Prosopis juliflora</i>	625	400	0.64	7	0.01	-0.63
Njangeen	Patar	Diourbel	project FIDA	1992	<i>Prosopis juliflora</i>	240	126	0.53	24	0.10	-0.43
Gapasel	Patar Liya	Fatick	PRE-CO BA	1988	<i>Acacia holosericea</i>	950	517	0.54	175	0.18	-0.36
Kër Useynu Jeng	Kër Samba Gey	Fatick	PASA	1992	<i>Anacardium occidentale</i>	285	229	0.80	229	0.80	0.00
S a n c Ngeraan	Maka Yop	Kaolack	PARCE	1988	<i>Eucalyptus camaldulensis</i>	625	358	0.57	213	0.34	-0.23
Kër Alfa	Ganjaay	Kaolack	PRE-CO BA	1992	<i>Eucalyptus camaldulensis</i>	625	440	0.70	440	0.70	0.00
Kër Sanu Jeng	Loro	Louga	PRO-BO VIL	1988	<i>Prosopis juliflora</i>	345	166	0.48	143	0.41	-0.07
Ñomdade	Caaméen	Louga	PRO-BO VIL	1992	<i>Prosopis juliflora</i>	325	190	0.58	120	0.37	-0.22

Kër Demba Ngooy	Fandeen	Thiès	PRO-VE RS	1988	<i>Eucalyptus camaldulensis</i>	1250	650	0.52	450	0.36	-0.16
Jëlëk Wolof	Noto Guy Jama	Thiès	CTL-Sud	1992	<i>Mangifera indica</i>	240	185	0.77	160	0.67	-0.10
total						5510	3261	0.59	1961	0.36	-0.24

Table 4. Plantation and payment characteristics , sorted as in Table 3. The column ‘sold or used’ refers to whether people primarily sold the plantation products for cash or used the products directly for their household.

village	project	year	agro-fore stry	pro-duct s	sold or used	payment use	natural re-generatio n	con-strai nt	payment (F CFA)
Ñangeen	none	1988	yes	none	none	group fund	n a t u r a l regeneration	termites	unknown
Njangeen	project FIDA	1992	yes	none	none	distributed	plantation	termites	13 140
Gapasel	PRECOBA	1988	yes	poles	use	small credit	n a t u r a l regeneration	water	40 000
Kër Useynu Jeng	PASA	1992	yes	fruit	sell	back into field	plantation	insects	36900

Sanc Ngeraan	PARCE	1988	yes	poles	use	small credit	plantation	water	unknown
Kër Alfa	PRECOBA	1992	yes	poles	use	school	plantation	water	39 600
Kër Sanu Jeng	PROBOVIL	1988	no	firewood	sell	group fund	n a t u r a l regeneration	livestock	unknown
Ñomdade	PROBOVIL	1992	no	none	none	group fund	n a t u r a l regeneration	livestock	17 100
Kër Demba Ngooy	PROVERS	1988	yes	poles	sell	small credit	plantation	water	137 000
Jëlëk Wolof	CTL-Sud	1992	yes	fruit	sell	back into field	plantation	insects	76 500

Overall, people used the sampled plantations for multiple uses. Notably, people farmed millet, peanuts, and black-eyed peas in eight out of ten plantations. From seven out of ten plantations, people had harvested poles, fruit, and firewood. Three of those villages mainly used the products for household needs while the rest sold the products for cash. Concerning the SRP cash payment, in only two out of ten cases did people actually use the cash as a reimbursement for actual plantations costs. In most cases, people placed the money into a community fund to finance small loans, community celebrations, and village expenditures, most notably the elementary school in Kër Alfa. When asked whether they preferred the plantation of exotic species or the natural regeneration of local species, six plantation managers preferred plantation of exotics while four plantation managers favored natural regeneration. When asked the most serious constraint to the success of the plantation, most managers identified the lack of water, with livestock, termites, and other insects also cited.

Analysis. SRP conducted a limited survey of medium-term survival rates in 1994. In their study, the survival rate of four 1988 plantations in the regions of Fatick, Kaolack, and Louga only fell from 59% to 54%, compared to a drop of 55% to 26% from 1988 to 1998 in the present survey.

The noticeable drop in survival rates over time highlights the basic problem that ecological conditions in central areas of Senegal do not favor the plantation of exotic species. *Eucalyptus camaldulensis* requires over 600 mm of water each year, but the meteorological station at Louga, for example, has recorded a mean annual rainfall in the period 1919-1993 of only 400 mm. Potential evapotranspiration at Louga is 2000 mm per year. These arid conditions mean that a plantation must be watered in the dry season of its first few years. Women expend much energy drawing water from wells 20-40 m deep just to provide their families with drinking water. Under these conditions, pouring water at the base of exotic trees borders the edge of practicality and decency.

Concerning the SRP cash payment, because people in most cases did not incur any cash costs to establish their plantations, most people did not need the payment, which SRP termed a ‘reimbursement,’ to realize the activity. In most areas of Senegal, other donor-funded regional projects had extensive programs in which they trained people in nursery and plantation techniques and worked with villages from the nursery preparation stage to tree planting day. The projects provided or helped the villages acquire plastic nursery sacks, seeds, shovels, and other materials. Only then did SRP arrive to offer the project the option of giving a cash payment to local people as a planting incentive. Interestingly, the word that the Wolof use for the cash payment reveals their perception of its role. Wolof use the word *neexal* meaning ‘that which pleases’ or ‘reward.’

Moreover, in most of the villages studied, SRP arrived in the middle of a long-term intervention by one of the donor-funded regional projects. Most villages had been working with a project for a couple years, then SRP helped with a cash payment in one year and departed. The village then continued working with the original project with no cash payments involved. This calls into question the necessity of the cash payment. Long before SRP, all the other donors in Senegal had abandoned planting subsidies in favor of a participatory approach where projects encouraged local people to plant just for the intrinsic ecological and economic benefits of trees.

Concerning replication, because donor-funded reforestation projects had worked with farmers and herders in all ethnic groups across all of Senegal, spontaneous replication is not a phenomenon relevant to SRP.

Concerning impact, the superposition of SRP over other donor-funded regional projects prevents the assignment of impacts strictly to SRP. Nevertheless, wherever trees survived, they produced a positive environmental and socio-economic impact. Surviving trees protect soil from wind and water erosion, increase soil organic matter, produce favorable conditions for nitrogen fixation, and provide poles, shade, firewood, traditional medicines, and fruit.

2.0 Brief Observations on other Activities

Community-Based Natural Resource Management (CBNRM) project. This project has the opportunity to support comprehensive land-use management planning at the scale of the communauté rurale. Such a plan would start with an inventory of natural and human resources then proceed with arrangements for what resource management activities would best fit on which pieces of land, with rotation systems for agricultural fields and pastures, and with inter-village agreements to implement these systems. Unfortunately, CBNRM has only modestly approached such planning. The current management plans provide descriptions of small activities that happen to coincide geographically, but the plans do not yet integrate these into comprehensive systems of resource use. The CBNRM plans, however, do improve upon the plans derived by the SRP test program. The SRP plans generally consisted of lists of SRP cash payment activities that happened to occur in the same communauté rurale.

Concerning the CBNRM monitoring and evaluation system, it generally tracks quantitative results, such as hectares of intervention or km of rock bunds, more than qualitative impacts, such as increase in native seedling density soil organic matter. Producing a baseline of just two or three ecological and socio-economic indicators would allow the project and USAID to evaluate positive impacts in the future.

USGS EROS Data Center environmental monitoring. In discussions at the UN administered Centre de Suivi Écologique and at the Institut des Sciences de l'Environnement of the Université Cheikh Anta Diop de Dakar, Senegalese personnel remarked that they valued highly the informal technical exchanges with USGS EROS staff. This benefit is in addition, of course, to the necessary monitoring of environmental change that the USGS EROS Data Center has undertaken.

Knowledge, Attitudes, and Practices (KAP) Survey 1998. The national KAP surveys can give results at a high administrative level, but averages by département or arrondissement cannot reveal changes in people's attitudes in the precise villages where USAID has supported activities. That would require more focused KAP surveys, such as those undertaken by CBNRM. Importantly, the interview forms should be written in the six national languages in order to provide consistent and valid survey results.

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Task Order No. 825
Contract NO. PCE-1-00-96-00002-00

Annex E.

Contribution of EROS/CSE to Long-term Environmental Monitoring in Senegal

Prepared By
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February 13, 1999

For

D13: 154

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)

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Long-term Monitoring of Senegal's Natural Resources

During the early 1980's USAID/Senegal supported the *Plan National d'Aménagement de Territoire* during which the natural and agricultural resources of Senegal were appraised and a national coverage of land use and vegetation cover maps produced. USAID's support was provided through the activities of a team from the United States Geological Survey (USGS). In 1983 and 1984, as part of the standard process of image classification and verification, USGS team members visited approximately 600 pre-defined sites across the entire country. A standardized procedure was followed in which each site was photographed and information collected on their biophysical and edaphic characteristics.

Although the data were collected primarily to serve immediately in the processes of image classification and map-making, they also serve today as a unique data base of the state of Senegal's natural resources from almost two decades ago. In the early 1990 (ie. 10 years later) USAID, in conjunction with U.S. Geological Survey's Earth Resources Observation System (EROS) Data Center, realized the potential of the original data base for serving as valid base line data both as a means of quantifying the rates of natural resources evolution over time and by area and for understanding the mechanisms of observed changes. To this end was developed the Framework for the Long-Term Monitoring of Senegal's Natural Resources (PASA No. 685-P-00-00005-00).

Further activities that capitalize on the competence of EROS Data Center have been added to the original agenda and these include:

- the use of Corona and Landsat imagery to assess natural resources changes over the last thirty years;
- experimentation on the applicability of aerial videography for the monitoring of USAID's indicators of natural resources practices;
- cooperation with the CONSERE during the development of the National Environmental Plan of Senegal;
- capacity building assistance to the Ecological Monitoring Center (CSE) of Dakar;
- socio-economic studies for assessing causes and effects of observed natural resources evolution in Senegal.

The project was initially set up in 1994 with start-up funding through the Senegal Reforestation Project (SRP). Later, additional co-funding was provided through the Community Based Natural Resources Project (CBNRM) and the United States Geological Survey (USGS).

1.0 Analysis of USGS-EROS/CSE Results

1.1 Introduction

A wealth of anecdotal material on the evolutionary trends of Senegal's environment and natural resources abounds and this can be obtained both from the literature and from directed interviews with local technicians and also with elders at the village level. The validity of the material can frequently be verified by cross-referencing but unfortunately rarely can known trends be quantified (the decrease in rainfall over time being perhaps the best known exception, see Figure **). However, in 1993 USAID/Senegal, in conjunction with U.S. Geological Survey's Earth Resources Observation System (EROS) Data Center initiated the Framework for Long-Term Monitoring of Senegal's Natural Resources (Wood, Tappan & Jacobs, 1995). The dual and complementary aims of the project are to:

- develop an independent and sustainable resource monitoring system for Senegal in partnership with the Ministry of the Environment, and
- research methodologies for tracking certain Natural Resources Management indicators pertinent to USAID's NRM Strategic Objective

In line with the first objective, the EROS team has worked principally in cooperation with Senegal's Ecological Monitoring Center (*Centre de Suivi Ecologique*), itself a renowned center of environmental monitoring excellence in Africa. Some limited assistance has also been provided to CONSERE (*Conseil Supérieur des Ressources Naturelles et de l'Environnement*) during the production of the National Environmental Action Plan and to the *Institut des Sciences de l'Environnement* (ISE) of the University of Cheikh Anta Diop, Dakar.

Cooperation with the CSE has taken the form of joint monitoring operations (both of environmental and socioeconomic variables) using remote sensing and ground-based monitoring techniques. The involvement with CSE has led to the transfer to the latter of considerable amounts of environmental monitoring competence and capacity building both by on-the-job training and formal competence development. CSE have benefitted only minimally from direct financial assistance.

The long-term monitoring of natural resources was recently complemented by the unexpected declassifying by the USA of very high resolution satellite imagery from the early 1960's which has allowed some important comparisons to be made with more recent images.

The second objective of the Long Term Monitoring of the Natural Resources of Senegal Project has been to investigate the use of alternative tools for the monitoring of certain NRM indicators, particularly of land use management practices that relate to Level III and IV of the Framework (Adoption of Certain NRM Practices and Biophysical Indicators). Air-borne videography has been

tested in particular and would appear to provide a convenient and relatively cost-effective method to obtain large amounts of information on certain NRM practices.

1.2. Background

At the present time we have at our disposal many cutting-edge methods for use in environmental monitoring: high/low-resolution satellite imagery; aerial photography and videography together with powerful analytical tools in the shape of image processing software and Geographic Information Systems (GIS). However, too frequently we lack a convenient series of base-line data to which the present day situation can be compared and thus quantifiable changes determined. However, in Senegal this is fortunately not the case since an excellent information base-line is available dating from the early 1980s.

In effect, a US Geological Survey team worked in Senegal in the 1980s as part of the USAID-funded *Plan National d'Aménagement de Territoire* (PNAT). During the PNAT the USGS team's main objective was to conduct an integrated inventory of Senegal's natural and agricultural resources resulting in the production of a series of land-use and vegetation cover maps (Stancioff, Staljanssens & Tappan, 1986). The maps themselves were developed from early Landsat images, verified during an extensive ground-truthing campaign with information collected from almost 600 ground control sites established between 1982 and 1984. Although these sites were not originally established as part of a monitoring network, they are now proving to be of major interest for the Long Term Monitoring of the Natural Resources of Senegal Project.

During the PNAT, site locations were selected from Landsat images and were originally intended to provide information required for the improved classification of the different land-use/land cover classes visible on the individual satellite images. Such "supervised" classification was used to ensure the increased accuracy of the different map series to be produced from the images during the PNAT.

Each ground site varied from 4 to 8 hectares and was selected to lie in relatively homogenous areas thought to be as far as possible representative of the surrounding area identified from the different satellite images. A data base was developed for each site containing details of approximate site location, general geomorphology, land use and detailed data on vegetation structure, formation, floristic composition and other measures of biodiversity. However, of additional interest to the present project activities is that a photograph was taken of each of the 600 sites. This last fact provided the possibility for identifying the exact location of each site (and photo) and thus allowed the collection of identical site characteristics during the 1990s and thus their comparison with the 1982-1984 data.

To date approximately 350 of the former sites have been revisited; no easy task since only approximate site locations were recorded during the first visits, and repeat photographs taken from

the (more or less) exact spot. The repeat photography has enabled some startling visual site comparisons to be made. However, of perhaps greater scientific interest is the fact that new, comparable data bases have been developed allowing comparison with the original ones. This has revealed a very dramatic and mostly negative evolution of the natural resources across the country during the approximately 10 year period covered. In order to facilitate the ease of future visits, exact site locations have been logged using Global Positioning Systems (GPS).

Real attempts have been made by the EROS/CSE team to understand these various and mostly negative changes that have been witnessed at different sites between the two visits. This has led to the inclusion of local socioeconomic studies and the development of a socioeconomic database. Many of the 350 sites lend themselves to repeated and prolonged study and a major aim of the project is that CSE will continue monitoring activities after the end of the current project in 1999. The modalities for future monitoring work by CSE requires in-depth consultations between USAID/Senegal, EROS, GOS and CSE (see Section 1.5 Recommendations for Further Activities).

EROS/CSE's ambitions do not end with the trend analysis. They have also made a concerted effort both to increase the capacity of the CSE in environmental monitoring and to publicize their environmental trend analysis at the very highest levels within the government of Senegal and the donor community. EROS's main activities within the scope of the project are outlined below:

1.3 Capacity Building at the CSE

The *Centre de Suivi Ecologique* is an interesting organization in its own right possessing, in the West African context, a probably unique structure and history. It started life as a pilot project of the United Nations Environment Programme in 1980, being set up to monitor the phenomenon of desertification in the Ferlo region of Northern Senegal and to introduce "modern" monitoring techniques to West Africa. It had an interesting beginning since it was the Sahelian testing ground for the use of imagery from the then new NOAA satellite specifically for the determination of seasonal vegetation production. This work was carried out by the GIMMS Group (University of Maryland/NASA). Between 1986 and approximately 1991 CSE passed through one project stage and into a second, this time funded by DANIDA through the U.N. Development Programme/U.N.Soudano-Sahelian Office. Until 1991 it was viewed as a classic UNDP/UNSO project. During the period 1986-1991 it developed its competence base in environmental monitoring and built-up a reputation as a center of GIS and environmental monitoring excellence. In about 1991, after several years of planning, debate and institutional wrangling, a concerted attempt was made to provide CSE with a sustainable administrative structure that would survive after project end, then due for 1994. With this aim, UNDP and GOS allowed CSE to begin to develop as a semi-autonomous structure in financial, administrative and technical terms. The very ambitious and novel medium-term program was that CSE - the former project - should be given the opportunity to become CSE - the financially autonomous environmental monitoring utility.

Thus EROS's cooperation with and assistance to CSE falls well within USAID's wish to help stimulate the development of Senegal's non-government sector. For CSE also the cooperation was a new type of initiative. Previously, CSE operated on a payment for services basis. However, with the EROS project, no/little financial payments were made to CSE and they instead were compensated for the services of their technicians by very considerable training and capacity building activities.

Capacity building has been of two forms: on-the-job instruction and by formal training. Training itself has covered many items:

- advanced aspects of the GIS software Arc/Info such as modelling and hypotheses generation. It is interesting to note that in 1989 U.S.G.S. provided the very first GIS training to CSE technicians and it is doubly pleasing to note that this assistance still continues today. CSE can proudly claim to have 2 or 3 of the very best African GIS technicians; a large part due to the long cooperation with U.S.G.S. It is hoped that this cooperation will continue, especially since CSE are enlarging their own GIS training program (CSE Technical Report, 1997) and constructing purpose-built facilities at their office site;
- the use of the relatively new GIS software Arc View. This software is a more user friendly and relatively simpler version of Arc/Info, useful particularly for map production where CSE already possess a high degree of competence;
- the use of aerial videography as a multifunctional monitoring tool. Training has been provided in the use of videography for the improved classification of high resolution SPOT imagery, for fine detail mapping purposes (production of video mosaics), for monitoring medium and long-term natural resources evolution, and for measuring NRM indicators (see Section 5.3). Aerial videography introduced a new monitoring tool in CSE's battery of techniques. It also offers considerable potential for replacing certain other of CSE's monitoring tools. For example, the systematic reconnaissance flights that have previously been undertaken by CSE to determine the density and distribution of livestock, of landscape features and, to a lesser extent, of wildlife distribution (for details see Ka, Marks & Faye, 1991);
- establishment and development of a long-term monitoring program based on the PNAT sites and the development of individual monitoring tools. This training aspect has served more to reinforce and broaden CSE's competence than to develop a new one. It should be noted that CSE has established and monitored approximately 40 field sites of 9 km² spread across the entire country (excluding the main agricultural zones), starting in 1986. These sites have already generated significant volumes of data, although much still remains to be extracted (perhaps an activity that EROS could consider developing). CSE

possesses a vast stock of data collected at these sites during the past 12 years. CSE is also responsible nationally for mapping and monitoring activities at the two ROSELT³⁸ sites based in Senegal. Assistance needs to be provided in two main areas:

- in developing a system for the better exploitation of data collected from CSE's own field sites over the past 12 years. This study would serve as a further tool in the long-term monitoring process leading to a much improved understanding of natural resources evolution in Senegal;
- in setting up and/or continuing the mechanisms of a medium to long-term environmental monitoring program of the original PNAT sites. From current results and thus knowledge of relative rates of natural resources evolution in different zones, sites could be classified on the basis of how frequently they need to be visited as part of a programmed monitoring system;
- techniques for undertaking structured and community interviews at the field level in order to try to begin to understand the general, climatic, socioeconomic and other anthropologic influences on the dynamics of natural resources evolution at the PNAT sites. These efforts have offered some interesting insights into the causes and effects of natural resources change over time and should continue to be reinforced;
- improved communication and vulgarization techniques for exposing environmental and trend analysis information. The most visually impacting product of EROS/CSE has been the trend analysis display that they have jointly developed and exposed to an extremely wide audience of decision-makers, donors and fellow technicians. This aspect of the work opens up a host of development ideas which are dealt with in more detail below.

Considerable work still needs to be undertaken with CSE in order to ensure that the full impact of EROS's efforts can be realized for the benefit of Senegalese social and economic development. Apart from the aspects suggested above (that is):

- fuller use of CSE's extensive data bases from their monitoring sites;
- continued long-term natural resources monitoring combined with additional investigations of causes and effects of natural resource evolution;
- adaptability of aerial videography for livestock and other forms of monitoring;
- continued training in advanced GIS development;

³⁸ ROSELT or Réseau d'Observatoires de Surveillance Ecologique à Long Terme

should be added:

- data mining from the vast library of aerial point photos available at CSE which go back to at least 1988;
- assistance to CSE for the production of scientific reports in order to expose the vast quantity of environmental data to a much wider international audience;
- investigation of Senegal's aerial photo archives some of which cover the Second World War period and could potentially provide base-line information going back over 50 years.

Furthermore, and potentially the most important aspect for future work is EROS/CSE's dramatic environmental change exhibition (Power-Point demonstration). It is imperative that this must not be considered as a final product but rather as an "appetizer" that should be adapted and updated so as to provide a powerful scientific tool and a unique public opinion weapon.

1.4 Aerial Videography and Indicators Monitoring

EROS have been developing the use of aerial videography as an advanced tool for the measurement of certain USAID NRM indicators. Unfortunately the technique has two relative disadvantages: First, it is only really useful for recording practices that are sufficiently large to be clearly identifiable from the video images. Thus, for example, new plantations of wind breaks, one of USAID important NRM adoption indicators, cannot easily be identified nor of course can the use of improved seed varieties, another key indicator.

Secondly analysis of the video tapes is rather cumbersome and time consuming and probably would benefit from the development and use of dedicated software.

Thus the value of videography as an NRM indicator monitoring tool is still to be proven. It is expensive to carry out; although it must be remembered that far larger areas can be covered in a much shorter time than by conventional ground-based monitoring techniques. Thus if cost/unit area is calculated, costs do not appear quite so exorbitant.

Further, it should be noted that aerial videography offers an unexpected and added bonus over some of the more conventional airborne techniques, such as systematic reconnaissance flights. This is that video tapes filmed during over-flights also possess a very interesting reserve of additional information that may not be seen as immediately pertinent during tape analysis but which could be extracted for use at later dates, if and when required. The presence of such potentially useful information as the distribution of economically valuable tree species such as the Baobab (*Adansonia digitata*) and *Acacia albida*, the size of livestock herds, the distribution of erosion features and of orchards/vegetable plots come to mind as likely to be of interest at some stage in the near future.

The Senegal experience in videography is not new since a similar exercise in indicator monitoring was carried out in Niger at USAID's ASDG II Project. In this case indicators of NRM practice adoption were carefully selected to correspond with the scale offered by aerial videography (demi-lunes, anti-erosion structures, live hedging, etc.).

1.5 Recommendations for Further Activities

Many areas of interest have developed from EROS's work in Senegal and particularly that which has involved the CSE. Some areas which should be investigated further are provided below:

1. Future and continued monitoring of PNAT and CSE field sites requires much reflection and planning. This should include the development of a future monitoring program, the classification of PNAT sites based on proposed monitoring frequency and the reinforcement of the socio-economic studies at the sites. However, it will be necessary to discuss the modalities for future monitoring work if CSE is to be the main player in this field. Thus in-depth consultation between USAID/Senegal, EROS, GOS and CSE will need to be undertaken in the near future;
2. USGS should investigate the possibilities for continuing to provide advanced training in GIS software (Arc/Info and Arc View) to CSE technicians. Means of supporting CSE's own GIS training program (CSE Technical Report, 1997) could also be investigated;
3. EROS should study the possibility of using aerial videography for monitoring the distribution and density of Senegal's livestock. Tests could be carried out using already registered video tapes and sampling/statistical methods proposed in a CSE document (Marks & Faye, 1992);
4. EROS should investigate with CSE the possibilities of better exploiting CSE's field sites data-bases as well as their large collection of aerial point photos;
5. EROS should help CSE to begin the investigation of Senegal's aerial photo archives as a means of pushing back the natural resources base-line to at least 1945;
6. Potentially the most important aspect for EROS/CSE's future cooperation should lie with the continued exploitation of their dramatic environmental change exhibition (Power-Point demonstration). It should continue to be developed for Government and donor use and it would appear logical to suggest that exposure of the exhibition to the nation's major religious leaders could lead to a very positive impact;
7. Finally, after 5 years cooperation with EROS, a mechanism should be investigated that will provide CSE with a far more "equal partner" status in continued scientific cooperation.

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Annex F.

Mid-Term Evaluation of the Community- Based Natural Resource Management (CBNRM) Program

Prepared by
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March 1999

For
USAID/Senegal

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1.0 Background ³⁹

The CBNRM project was authorized in August, 1993, and a Cooperative Agreement was signed in June 1994 with SECID to provide the long-term technical assistance team. Virginia Tech is the lead Institution for SECID, and Winrock International is the major subcontractor. The program purpose is: “to increase local community participation in the identification, planning use and conservation of natural resources”. The program goal to which this should contribute is: “to increase private sector incomes derived from the exploitation of natural resources, consistent with decentralized, sustainable natural resource management”. In addition there is a sub-goal “to increase soil productivity”.

Initially, the COP and the land use planning technical assistant transferred directly from the SRP to the CBNRM program, along with a portion of the Senegalese staff of SRP. The transfer of this staff with experience in the Test Program of SRP was designed to get CBNRM off to a rapid start. But while CBNRM had TA staff present during the first 6 months of FY 1995, they were still heavily involved in writing the SRP Final Report and Test Program Final Report, and in the SRP Final Evaluation, as well as wrapping up the SRP project.

During FY 1995 the CBNRM team did prepare the Life of Project (LOP) Work Plan and budget as well as the work plan and budget for FY 1995. GOS technical personnel including the Project Director were named, the Project Management Unit (PMU) established and administrative support personnel hired. TOR were prepared for a group of studies needed to begin implementation of the program, particularly related to the training needs assessment and training plan and elaborating a process for developing land use management plans (LUMPs). The administrative and financial procedures manual were prepared. Criteria for the selection of CRs were elaborated, presented at the Project Launching Seminar, and approved. This Project Launching Seminar was held in July 1995, on year after the official start-up of the program, but only 6 months after the SRP Final Evaluation, at which time the Test Program Final Report still had not been completed. Numerous contacts were made to begin collaboration with partners including CONSERE, CSE, Peace Corps, the body representing CRs at the national level, and the national service responsible for the CERPs. Diagnostic surveys were begun in the peanut basin, using the approved selection criteria, to select the first generation of five rural communities.

During FY 1996, 15 CRs in Fatick, Kaolack, Kolda and Tambacounda were selected for participation in the program, and LUMPs were prepared for the first 5 CRs in Fatick and Kaolack.

³⁹ Annex G by Paul Wild has a detailed analysis of CBNRM, among several other programs, that provides greater detail on a number of points than is included here.

Before the LUMPs could be prepared: protocols had to be signed with each CR; two media campaigns to increase local awareness about the CBNRM program were executed; an election process was facilitated which resulted in the election of a representative NRMC in each CR, which in turn elected its own officers; the position of animator was advertised, candidates tested, and an animator was hired in each of the 5 CRs. The NRMC members, animator and CERP staff began to receive training:

- a one week seminar on the organization of NRM committees;
- a one week seminar on grant administration procedures;
- a one week seminar on rapid rural appraisal techniques [possibly indicating that it was more of an RRA than a PRA process].

The training in the implementation of a PRA or in this case RRA process was particularly critical to the LUMP, since it was intended to result in a process by which the population would identify problems, constraints, and potential solutions which would serve as the basis for the LUMPs. No field interventions were initiated during FY 1996 because the LUMPs were not completed until August 1996, which was too late in the agricultural calendar to begin field interventions. The process was begun again in late FY 1996 to prepare LUMPs in the second generation of 10 CRs.

Several other training activities were arranged for various staff and participants in the US and third countries. Other accomplishments included: designing and implementing a national level NRM-focused, KAP survey; designing a local monitoring system; conducting an economic and financial analysis of NRM practices related to establishing the extent to which different practices would be subsidized under the matching grant program; a number of consultancies in different areas; and participation in designing baseline studies with CSE and in developing new NRM policy with CONSERE.

During FY 1997 CBNRM continued activities in the 5 first generation CRs. These included: Restructuring of the NRM committees to adjust membership following Rural Council elections; elaboration and selection of 146 private sector micro-projects (among 600 submitted) for execution under 12 themes identified in the LUMPs; identification of 13 public sector activities based on the LUMPs, and completion of the CR baseline maps. Training programs continued with the NRMC, CERP staff and animators receiving:

- a one week workshop on participatory communication techniques;
- training on the technical and financial management of micro-projects;
- training on monitoring and evaluation procedures.

In addition a pilot functional literacy program was initiated in Medina Sabakh, several inter-village visits were organized, as well as a study tour to Burkina Faso.

In the 10 second generation CRs: protocols were signed and bank accounts were opened for each CR; awareness building campaigns were implemented in each CR, zonal level sub-committees were elected, who in turn elected the NRMC members from among their number, and the NRMC members elected their own officers; the animator positions were advertised, candidates tested, and an animator selected; initial training was dispensed to the NRMC members, CERP staff, and the animator; an improved PRA process was implemented, and the LUMPs were prepared.

Other activities during FY 97 included: a number of studies by consultants; collaboration with the CONSERE in the elaboration of the NEAP; implementation of baseline studies in each of the first generation CRs; and elaboration of monitoring procedures and techniques.

In FY 98, CBNRM continued activities in the 1st and 2nd generation CRs. Five 3rd generation CRs were selected towards the end of the year, after discussions which led to a reduction in the number of CRs targeted from 50 to 30, and then to 25. The 3rd generation CRs were selected too late to begin much activity during the course of the fiscal year. The program finalized the baseline studies in the first generation and implemented similar baselines in the second generation CRs. Bio-physical studies were implemented with CSE, and a system for continuing such studies in the future was established. A number of consultancies were implemented. Finally, the CBNRM team was heavily involved in the elaboration of an unsolicited proposal to extend the program to 2006 (from 2001) and identify CBNRM's potential contributions to the new USAID Country Strategic Plan, particularly:

- SO1: Sustainable increase of private sector income-generating activities in selected sectors; and
- SO2: More effective, democratic, and accountable local management of services and resources in targeted areas.

CBNRM identified numerous ways that it can and does contribute to these new SOs in its proposal, annual work plans and several special reports. The program moved sharply in the direction of responding to the democracy and governance objectives when it was redesigned to “focus as much or more on decentralization as on NRM”. Given the program purpose: “to increase local community participation in the identification, planning use and conservation of natural resources”, the program has focused more on the process of planning and developing improved public management of those resources, than on increased use of NRM practices and bio-physical impacts *per se*.

However, the indicators chosen by USAID/Senegal to assess program progress remained firmly fixed on the adoption rate of 7 specific NRM practices (see Chapter 3). It would appear that the monitoring indicators for SO2 and the program purpose, or at least the interpretation of that purpose which focuses on democratic process and public management of natural resources, remained out of sync throughout the life of SO2. From the perspective of the SO2 indicators, land use planning and public management of natural resources would only be a means to an end, i.e. increased adoption of NRM technologies and increased bio-physical impacts. From the perspective of the program staff,

it is impractical to expect the program to accomplish more than improving land use planning and public management of natural resources in targeted CRs, given the limits of time and resources available. There is a significant concern that CBNRM will be pushed by new USAID programming under the 1998-2006 CSP, which has no AG/NRM SO (NRM remains a crosscutting theme), to de-emphasize the NRM objectives even further.

Certainly CBNRM has used considerable staff time and resources attempting to adjust to the ever changing priorities of USAID/Senegal, particularly under the re-engineering process. The attempt to respond has undoubtedly interrupted program focus and hindered its effectiveness. These changes and the difficulty in reorienting the program to focus specifically on either the old SO2 monitoring indicators, or the indicators for the new SOs, have undoubtedly contributed to the recent poor relationship between the program and USAID/Senegal.

1.1 Transition from Micro-Realizations to Sub-Projects

CBNRM changed its approach for field activities in 1998, from the micro-realizations of 1997 to a sub-project concept, which integrates NRM and income-generating activities in a single package for the sub-zone. The concept provides a program focus which responds directly to the priority NRM issues in the LUMPs. In part it reflects a stronger orientation towards addressing constraints within the spatial/geographical context of the LUMPs. It also reflects a reorientation from working primarily with individuals to primarily working with groups. It is interesting that the SRP Test Program tried working primarily with groups, but found that the portion of contracts actually executed among those signed was lower among groups than for individuals. The reason for abandoning the group approach used during the Test at the beginning of CBNRM is never identified as an explicit decision nor explained. However, in initiating the micro-realization concept CBNRM abandoned the group approach and with the sub-project concept returned to it again.

CBNRM staff reported that they were disappointed at the lack of impact of the micro-realizations, which were very small, scattered and not distributed in a representative manner. They also were disappointed in the very narrow range of themes present among the 12 sub-projects developed by NRMCs as the focus for interventions during the micro-realization phase. These consisted almost entirely of composting and field (eucalyptus) plantations, with a little bit of erosion control.

It also seems likely that CBNRM had trouble dealing with the hundreds of proposals, especially since only about 1/3 of them conformed to program requirements. It became evident that it would be necessary to implement hundreds of these micro-realizations to have any significant impact, but the NRMCs and CERPs did not have the capacity to get hundreds of proposals prepared correctly. Furthermore, providing the logistics for, or supervising and monitoring hundreds of micro-realizations did not appear to be within the capacity of the program staff and its CR-level representatives.

The sub-project approach allows CBNRM to place much of the responsibility for organizing, logistics, etc. on the sub-zone level federations or a local association. A federation might organize such that several groups or GIE agree to complete some of the activities under the contract and several dozen individuals agree to complete other portions of the sub-project contract. This simplifies the logistics for the program in that program representatives only have to interact with the officers of the federation, and not with each of the groups and individuals covered in the contract. The approach makes great sense logistically. However, implemented with program funding alone, the sub-projects are very limited in the number of hectares that will actually be affected and the number of people who will directly benefit from the NRM or income-generating activities. Since the sub-contract is a one-shot deal for the sub-zone, albeit spread over a three year implementation period, there is little or no opportunity for additional community members to participate as they see the advantages achieved by their neighbors. The limitation on enrollment allows CBNRM to determine the costs and plan the funding of the sub-project in advance, in addition to allowing the program to report the outputs achieved by the end of the program.

Preparing the sub-project proposals has largely been a top-down affair, rather than a participatory process. In many cases, the sub-projects were elaborated in workshops held in each CR among the NRMC members, CERP staff, animator, and representatives of the PMU. The group used the LUMPs to identify the two primary constraints in each zone, and developed a package of NRM and income-generating activities around each of those constraints. Although federations or promoters are asked to accept the responsibility of implementing these sub-projects, they had not yet been identified or created at the time the workshops were held. There are a few cases in which groups or associations did present proposals to the NRMC for consideration and financing, but in most cases the sub-projects were prepared entirely by the elected representatives and program staff. The sub-committees representing each zone were presented with two (or sometimes three) sub-projects and asked to determine which groups or villages in the zone would be interested in participating in each sub-project. Then an effort was made to organize federations or find associations that corresponded to the groups and villages interested in each sub-project that would accept responsibility for implementing them. The promoter was identified or created in the context of an already defined sub-project.

The NRMC members seem to believe that it was their right and duty as duly elected representatives to prepare the sub-projects in this manner. But it raises an important issue about participation and the role of representation. It probably is impractical to have village level (town meeting type) participation in all activities when attempting to scale up to operating at the CR level. But even in successful representative structures, higher level organizations like the NRMC do not prepare plans and activities in isolation from other levels of representation closer to the grassroots. These lower levels of representation are integrated into the process, or at least given a chance to review and comment on the results of the deliberations of the higher level representatives. Those types of democratic procedures were not followed in preparing the sub-projects.

Furthermore, the basis of participation and a demand-driven approach has always been that a local organization (in this case the promoter, federation or association) would have the capacity to make a proposal to the funding/co-financing organization regarding something that it felt was important and wanted to do. That is the basis for the argument that participation leads to sustainability. But the capacity to prepare a proposal is not yet evident in the CBNRM intervention areas, and no such participation was involved in the preparation of most of the sub-projects.

In the newer generation CRs, federations of local associations, groups, GIEs, etc. were established to assume the responsibility for implementing the sub-projects. This primarily meant, making contact with groups and individuals throughout the sub-zone, to see who was willing to accept responsibility for implementing a half-hectare eucalyptus plantation, or a kilometer of wind break, etc. It also meant determining which group(s) or individuals would receive the subsidy to fatten 5-10 animals, where the 1 garden or the 1 or 2 fruit orchards for the entire sub-zone would be located, etc. There was great interest in participating in the income-generating activities, when it was thought that these participants would have access to credit to finance the activity. Since it has recently been learned that credit will not be available, it is not clear whether groups or individuals will be able and willing to come up with the cash contributions required to move forward with those activities.

The sub-project approach made a lot of sense under the assumption that credit would be available to allow a significant number of groups and people throughout the sub-zone to participate. The concept provides a program focus which responds directly to the priority NRM issues in the LUMPs. With credit, it might have been possible to do additional contracts each year, or even leave it open ended, allowing additional people to participate each year. Given the one-shot nature of the sub-project contract, and the very limited number of people or hectares in each sub-zone that will be directly affected by the sub-projects in the absence of credit, it seems unlikely that the sub-projects will have much bio-physical or people-level impact. This is not to imply that approaches using credit are easy to implement or certain in their results. Rather, it is a question of whether the program can facilitate the participation of a critical mass of stakeholders in any specific zone of intervention. Without that critical mass, the program has little chance of achieving significant bio-physical impact or sufficient people level benefits that stakeholders buy into the program's objectives and judge that it is worthwhile to continue the effort.

The micro-realization phase focused primarily on implementation of interventions by individuals, but CBNRM would only co-finance activities which were primarily NRM, rather than income generating, activities. Under the sub-projects, the list of activities acceptable for co-financing expanded to include some income-generating activities, but the two types of activities remain in separate categories with distinctly different rules of participation. As originally introduced, income-generating activities would only be funded under credit arrangements while NRM activities continued to receive matching grant co-financing. When it was not possible to arrange to make credit available directly through the program, none of the income-generating activities accepted by the program were funded in fiscal 1998. Only activities on the list of acceptable NRM activities were initiated in fiscal 1998. For fiscal

1999 new rules of participation were developed, which included income-generating activities under the auspices of the matching grant program, but with distinctly different conditions than NRM activities. These required the participant/promoter to pay a significantly higher percentage of the costs for income-generating activities. While this makes perfect sense within the logic of a top-down program whose priority is to promote the use of NRM technologies, rural participants seem to interpret this as discriminating against their legitimate needs and priorities. Many participants are simply angry or disappointed, others complain that this is contrary to their sense of the manner in which participatory programs are supposed to operate. This creates great skepticism about CBNRM and its claims to be participatory. Given these problems, as well as the severe limitations on the number of households that will be permitted to benefit from an income-generating activity, it is doubtful that the sub-projects result in any substantive integration of NRM and income-generating activities in the minds of participants. It also seems impossible for the sub-projects to directly improve the lives of anything approaching a critical mass in any specific project area, within the time frame of the CBNRM program.

In the future it may be useful to distinguish more clearly between public work activities and activities which primarily target individuals, even though the mode of organization and addressing logistics for both types of activities may be through local federations and associations. Subsidies have a legitimate role to play in supporting public works such as watershed management, improving waterways and ponds which benefit several villages, planting green barriers or wind breaks on an inter-village scale, improving pasture land or forests that serve several villages, etc. In the context of an African village, it is more difficult to claim that it is legitimate to heavily subsidize income-generating activities by one or two villagers, but not others who desire to participate. One can support income-generating activities of a local association, even if it benefits a particular category of the population such as women, farmers, etc. and includes a significant portion of the locals in that category. It is more difficult to respect concepts of fairness, if one uses a federation of local associations, but in fact provide assistance to only one or two of the various associations with seemingly equal claim to receive benefits.

Furthermore, it is difficult for a “participatory” program to claim that it will subsidize a number of participants to do NRM activities, but provide no support for the productive activities which the NRM techniques should support, and which are a much higher priority to the villagers. Whatever the claims to a participatory planning process, villagers know they did not vote to have their needs and priorities ignored. Government services may be able to operate programs that impose external priorities, but it is very difficult for a program operated by a committee elected from the local population to function in this manner. It is also difficult for a program operating in this manner to be accepted and respected as either participatory or responding to the needs of the population.

The matching grant approach used to finance the sub-projects requires that the promoter or local organization (or a collaborating individual) make a cash contribution to the estimated cost of materials

of the activity, in addition to providing the labor.⁴⁰ If the promoters/local groups can demonstrate that they already have a portion of the material necessary such as shovels, rakes, picks, etc. this can substitute for a portion of the cash contribution. They are required to contribute 15 percent of the material costs for any of the 17 NRM activities incorporated into the sub-projects, but 50 percent of the material costs for the income generating activities. In all cases, the local federation/promoter is required to come up with a cash contribution to the activity. The program no longer provides cash payments to the promoter, but rather limits its contribution to providing the equipment and materials specified in the contract, with the help of the cash contribution from the promoter. Field surveys indicate that promoters do not always think they need all of the equipment and materials that the program supplies and towards the cost of which they are required to make a contribution. Furthermore, they are not involved in the procurement process, and sometimes do not believe that an item is worth the cost/value stated by the program.

In FY 1998, the sub-projects were designed and implemented during a period in which CBNRM was negotiating with USAID/Senegal for additional funding to provide a credit or credit guarantee fund. This issue was not resolved prior to the 1998 rainy/agricultural season and only the NRM components of the sub-projects were initiated. The issue of making credit available through the program was finally resolved in the negative, in December 1998 or January 1999. This is creating a significant operational challenge for FY 1999. In a number of cases, the sub-contracts originally negotiated contained only the NRM components and the cash participation required was relatively inexpensive (based on the 15% of material costs). However, when the credit was not forthcoming, CBNRM decided to finance the sub-project effort within the limits of the funds already available to the program. Adding the income-generating activities to the sub-contracts often resulted in the cash contribution required increasing 2-4 times.⁴¹ This change has created/contributed to a significant level of skepticism about transparency within the program on the part of many villagers, and even NRMC members. The challenge to collecting the cash contributions required to implement the sub-projects has greatly increased. If they are not collected quickly, the activities planned for the FY 99 agricultural season are likely to be derailed. The problem may be eased by rescheduling some of the income-generating activities and the corresponding cash contributions for FY 2000 or FY 2001. Still it raises questions about whether the sub-project approach is practical if participants do not have access to credit, and about the effectiveness of the matching grant approach. It also raises questions about whether seedlings will be available for planting at the beginning of the rainy season this year, or whether for the third year in a row, many seedlings will fail to survive because they are not available on a timely basis.

⁴⁰ The program will share the cost of some specialized labor if a technician is required for a short-term activity, but otherwise all labor costs are the responsibility of the promoter.

⁴¹ In one case in Kolda, the required cash contribution actually increased 12 times from 125,000 FCFA to 1.5 million FCFA.

1.2 Outputs

CBNRM has had only two years of field level interventions to date and is only beginning to generate some significant outputs. During FY 97, CBNRM continued using the matching grant approach, similar to what was done in SRP. Six hundred applications were submitted, but 400 were rejected without investigation, as not conforming to the criteria specified in the field guide. Of the 200 applications investigated, 146 were co-financed. Applicants surveyed by the impact assessment team received no feedback as to why their application was rejected, and allowed no chance to correct problems that may have caused their application to be rejected. While the FY97 Annual Report, identifies the 146 micro-realizations that were proposed, the FY 98 Annual Report, unfortunately, does not report on the results obtained. The FY 98 report only indicates that the 146 private sector micro-realizations implemented under the matching grant approach in FY 1997 did not meet expectations because of their small scale, the fact that they were very scattered, and the distribution was not representative.

For FY 1998, CBNRM revised its approach and introduced the sub-project approach which uses a limited matching grant concept, but only provides in-kind assistance, rather than cash payments. The outputs for 1998 were limited to activities regarding CBNRM's narrowly defined list of 17 NRM practices. Income-generating activities were designed to be financed through credit, and agreement had not yet been reached with USAID/Senegal about whether credit would be made available directly through the program, as proposed by CBNRM/SECID. Given these problems, the bio-physical outputs of the 30 sub-projects begun during FY 1998 were very modest, even though they involved 1,980 men and 3,688 women, or a total population of 5,668. The bio-physical outputs remain heavily dominated by classic reforestation activities, particularly block plantations of eucalyptus, with only limited representation of broader NRM themes such as natural regeneration or the control of soil erosion caused by water:

- Field plantations 176 ha
- Fruit orchards 5 ha
- Live fences 10 km
- Wind breaks 14 km
- Pasture enrichment 49 ha
- Improved fallow 4 ha
- Green fire break 2 km
- Natural regeneration (assisted) 24 ha

In addition, over 1250 people, mostly women, have attended 42 classes in functional literacy (and numeracy).

Other accomplishments: CBNRM has continued the tradition of involvement in Forestry Code policy begun under SRP. The Forestry Code was updated in April 1995 and again in January 1998.

CBNRM also continued support for CONSERE, begun under the SRP. The NEAP which CONSERE was tasked to prepare was presented to a national seminar for approval in September 1997, and was officially accepted by the government in January 1998, as well. CONSERE was also responsible for the development of the National Action Plan for the Fight Against Desertification, which was approved by a national seminar in October 1998.

1.3 Impacts

CBNRM's initial impact in each CR is the development of a land use management plan with significant environmental content. While the development of these plans was not participatory in the 1st generation CRs, the process has become much more so in recent generations. In recent generation CRs, small teams consisting of NRMCM members, CERP staff, and private sector consultants spend 8-10 days going through a PRA process with each of 8-12 different groups across the CR. These groups represent village clusters, or an important central village and surrounding villages and hamlets, typically with several groups in each zone tentatively identified from preliminary information. The group results are aggregated to represent the results of zone, which in turn are aggregated to produce a global plan for the CR. In some cases the plans represent more a wish list of everything the population would like someone to do for them. The results have been used primarily to propose NRM activities, while activities related to economic growth and income-generation have sometimes been neglected. The information which goes into the plans provides a basis for regional planning at the CR level, which could be used by the government, donors, NGOs, etc. for planning activities in several sectors.

While it would not be appropriate to claim that these plans constitute a Landscape Ecology approach or are the same as Regional Planning being advocated and implemented in USAID programs in other countries, they share a number of common features and objectives. It would seem appropriate to develop an active exchange between CBNRM and these other types of programs, which should each have something to contribute to the other.

CBNRM is beginning to obtain some significant impacts in the area of rendering operational the government policy of decentralization through the NRMCMs. These NRMCMs constitute a group of about 300-350 persons (in addition to the approximately 100 CERP staff and 20 animators) who have received a significant amount of training that has greatly increased their capacity to serve as representatives of civil society and address issues related to land use and community planning. These NRMCMs and their members are recognized and appreciated, particularly in the newer generations of CRs:

- For the wide range of groups found in the local civil society that are represented on the committees;

- For the democratic procedures used to elect these representatives, including the election of local representatives to sub-committees, and then the election of the committee member(s) among the delegates representing a particular socio-professional group from different zones; also the use of secret ballots; and
- For the accountability and transparency that characterizes their procedures.

In the recent elections for the Rural Councils, several NRMC members were elected in recognition of their skills and leadership qualities. And in several CRs, the NRMCs were asked to help the Rural Council with its annual budget exercise. Recognizing these advantages Rural Council members have started to request that they also be trained by CBNRM, and the program has planned several courses specifically for Rural Council members in the FY 1999 work plan. To the extent that Rural Council members are envious of accountability, transparency and democratic procedures, this is certainly a positive impact.

CBNRM has established rules which automatically place at least a few women on the NRMCs, it also gives preference to women's groups with regard to functional literacy training and participation in the sub-project interventions. Individual women have demonstrated competency as representatives of civil society and as officers of public decision making bodies. This combination of increasing economic clout and personal capacity is beginning to change perceptions of and attitudes towards women at the local level.

Although the new Forest Code is still somewhat restrictive, Senegal now has a Forestry Code that at least allows people who plant or maintain trees, to assume that they will be able to harvest those trees and benefit from their efforts. This step was crucial for the promotion and acceptance of many tree related NRM practices. Senegal also now has national and regional action plans for addressing environmental issues and the fight against desertification, but any serious effort to put these plans into action is only now beginning.

The combination of SRP and CBNRM have provided years of training to MEPN and particularly the Forest Service This training has targeted helping change attitudes in support of foresters becoming more of a development agent and less of a policeman, introducing agroforestry, etc. While there has undoubtedly been progress, it has been less than one might have hoped for. Many, if not most, rural residents interviewed during field visits claim that there has been little or no change in the behavior of forestry agents; agroforestry and issues like natural regeneration still seem to be receive less support than they deserve (or receive in neighboring Sahelian countries); and Senegal is decidedly a laggard in adopting approaches in which local residents participate in natural forest management. Given this situation, it is difficult for the impact evaluation team to identify a significant positive impact from all this training.

Perhaps the biggest impact that the CBNRM program is likely to have will be determined by the success of its attempt to prove the concept that programs can successfully target development

interventions at the CR level, rather than at the traditional village level. While CBNRM has certainly has some promising initial results, it is still too early to determine whether, or to what extent, that concept will be proven.

1.4 Participation and People-Level Impacts

CBNRM has been much less successful to date at achieving people-level impacts, either in terms of bio-physical NRM results, or in terms of the participation of people at the grassroots level (village and population, as opposed to their representatives):

2. There has not been time for the reforestation outputs to produce much in the way of impacts. For the most part, these trees are not yet large enough to produce fruit or to harvest for poles, or even to form an adequate windbreak or live fence. Bio-physical outputs and people-level impacts should begin to expand in FY 1999. But without access to credit to expand participation, the bio-physical outputs and people-level impacts will remain quite modest, particularly relative to the size and populations of the CRs, even if all of the sub-projects planned for the life-of-the-program are successfully completed. It seems unlikely that the program will touch a critical mass of rural residents in any CR, zone or sub-zone. If people-level impacts remain weak, the program risks being rejected by stakeholders, as not meeting their needs and expectations. If the stakeholders do not buy-in to and internalize the program's NRM objectives, there will be little sustainable NRM impact. The positive achievements in governance, risk being disregarded or repudiated because CBNRM did not respond to stakeholders overriding needs.

The sub-projects were designed without the participation of the promoters/federations who are intended to implement them and without other grassroots-level representatives such as the zonal sub-committees. This would appear to compromise the chances that the population or even the organizations intended to implement the sub-projects will buy in to their objectives, without which, there will be little sustainable impact.

Given these two issues, the sub-projects as presently constituted, do not appear to be a particularly effective means of achieving program objectives.

- CBNRM should take another look at sub-project designs, with the full participation of the relevant sub-committees and federations/promoters.
- CBNRM should do a mid-term evaluation of the sub-project approach and its impact, particularly in light of the non-accessability of credit to participants.
- CBNRM should explore linkages with programs that do focus their interventions and interactions at the grassroots level, and can help provide people-level impacts, for example, enterprise development programs such as those being formulated under SO1.

- CBNRM should consider developing some easy-access collaborative activities to complement the participatory approach, increase people-level impacts, and allow some “quick victories” in which the population reaps some benefits from collaborating with the program in the short-run.
 - CBNRM should test some of these recommended approaches in the 3rd generation CRs.
3. In the CR of Fissel, the impact assessment team encountered a local association called Jig-Jam (see Annex D). Jig Jam was involved in a reforestation program in the early 1990s, but found that villagers were not particularly interested. However, villagers wanted to do something and Jig Jam identified the protection of natural regeneration, especially *Acacia albida*, as a promising approach. In collaboration with village associations, Jig Jam helped organize a village-level protection of natural regeneration scheme, which has expanded to include all 31 villages in the CR. Jig Jam helped create an auxiliary force of “forest guards” to whom the Forest Service has ceded the right to levy fines for illegal cutting of *kadd*. These auxiliaries are each paid 2,500 FCFA per month, or a total of about \$1800 per year for all 31.⁴² Some of the results over a four year period include: 1) A visible increase of *kadd*⁴³ trees throughout the CR, and a perceived increase in agricultural productivity and rainfall; 2) A significant increase in the availability of *kadd* pods to feed to livestock; 3) Improved links between rural producers and the Forestry Service with the latter viewed as a partner in development; 4) Decentralized governance in action with benefits accruing to rural producers; and 5) A success story that is entirely due to local-level efforts in natural resource management.

A program with a somewhat similar objective but a different approach is the “seeds for trees” program in which Peace Corp and Winrock collaborate. Here farmers are offered improved seeds to plant the field or area on which they agree to not cut all of the multi-purpose (but particularly *kadd*) trees when they clear the field for cultivation. Trees are often staked or the stems painted to indicate the desire to preserve these trees to family members. It too has reportedly resulted in a significant increase in the number of field trees, which are expected to produce increases in agricultural production as well as contribute fruit, nuts, or pods and perhaps over time a limited amount of fuelwood.

Training to produce improved cook stoves is an activity that is found in several of the sub-projects, which might have important people-level impacts, particularly if training were to offered throughout the CRs. The improved cook stoves: 1) cost little to construct; 2) save significant amounts of fuelwood; 3) reduce cooking time; 4) reduce the danger of burns, particularly for young children, and 5) are easy to construct and repair, ensuring sustainability after the program ends. A few artisans assisted by the NGO ATI with funding from the PVO/NGO Support

⁴² Which is less than the investment required for a one hectare mono-culture woodlot.

⁴³ Kadd is a local name for *acacia albida*.

Project have sold over 30,000 of the more expensive metal version of the improved cook stoves. In addition to the savings in the time and effort necessary to collect the wood (or cost), those 30,000 stoves should save 3,000 tons of fuelwood each year (even at the very conservative estimate of saving 100 kg of fuelwood per stove, per year). This 3,000 tons of fuelwood saved per year is the equivalent to the total wood production on approximately 850 hectares of Eucalyptus plantations, or several thousand hectares of traditional slow growing species. These stoves will diminish fuelwood consumption by more in a single year, than the total reforestation activities of the 95 sub-projects planned for the 1st and 2nd generation CRs will eventually contribute to the wood supply. Most of the training to produce the clay stoves can actually be done by local women, once the program is initiated.

The Jig Jam protection scheme, the “seeds for trees” program and training women to construct improved cook stoves are the types of activities that promise to provide a “quick victory” for CBNRM or future SO2 programs, and potentially greater people-level impact than the sub-projects, at lower cost. The NRMC, sub-committee and federation structure would seem to lend itself particularly well to the type of land use management activity which Jig Jam initiated in the Fissel CR.

- CBNRM should consider developing some of this type of “quick victory” activities as complementary to, or substitutes for, the present sub-project program, particularly in the 3rd generation sites.
4. Beginning in the early 1980s, the government established a policy of progressive disengagement from providing basic rural services which by the early and mid-1990s had resulted in the incapacitation and outright dissolution of many of the parastatal structures which previously provided such services. In the absence of such services, the enabling conditions for a productive and profitable agriculture do not exist, and the relationship between production and income becomes tenuous. Without these enabling conditions, CBNRM, or any rural program, is likely to make a rather limited contribution to the overall goal of increasing private sector revenues. USAID/Senegal must share the burden of this deficiency, since the national situation existed at the time of program design, and CBNRM has attempted to work with USAID/Senegal to address this problem.
 - USAID and CBNRM may need to address changing the goal level objective to something that is more realistic under existing conditions.
 5. An area in which one sees improvement in the CBNRM program is the targeting of Rural Council members for management and financial training, as well as the greater integration of the Rural Council into the CBNRM representative structure. All Rural Council members are automatically members of the sub-committees in the zones where they reside. In addition, the Rural Council delegates one council member from each zone to represent the Rural Council on the NRMC.

CBNRM is trying to work with the Rural Council to co-finance some public good/public service activities that would benefit a larger public than the groups that implement the activities. The Rural Council is the legally established decision making body at the CR level. Under the Decentralization Law, the NRMCs fill the role of advisory groups which serve at the pleasure of the Rural Councils. It is not clear whether or not it will be the pleasure of the Rural Councils to have the NRMCs continue in this role after the end of the program. Thus, an integration or very close working relationship between the Rural Councils and NRMCs is necessary for the sustainability of the accountability, transparency and democratic procedures which the NRMCs have come to represent. While the continuation of the NRMCs appears desirable, it does not seem to be absolutely necessary to the extent that the Rural Council takes on (more of) the characteristics of the NRMC. There are 3 trends which provide a basis for optimism: 1) Rural Council members have recently expressed the desire be trained in the manner of the NRMC members; 2) In some CRs, NRMCMembers have been asked to use their skills to help the Rural Councils with their budget process; and 3) Some NRMCMembers have been elected to the Rural Councils, providing hope that the Rural Councils may move towards greater representation of a cross-section of civil society in the CR.

- CBNRM should target the Rural Council for training similar to that provided to the NRMCMembers.
 - CBNRM should not voluntarily disband the NRMCMembers unless there is significant progress on the part of the Rural Councils, towards becoming more representative of the different groups that make up civil society in the CR.
5. The program has also greatly improved the process by which the NRMCMembers are elected, but starting the election process at the zonal/sub-committee level. Whether even this is beginning at a low enough grassroots level for the representative structure to be perceived as truly representative of the population, still remains to be seen, but it is surely a big step in the right direction. The sub-committee is structured along the same lines as the NRMCMember in that it consists of elected representatives of the socio-professional groups in the zone. It however goes a step further in that it includes *de office*, any Rural Council members living in the zone as well as all of the chiefs of villages in the zone. Once the 3 or 4 sub-committees are elected, they then meet to elect the NRMCMember from among their ranks. The 3 or 4 representatives of a given socio-professional group, for example herders, meet and select one from among their number to represent all herders in the CR on the NRMCMember. In a CR with 3 zones, each sub-committee elects 3 delegates to represent the sub-committee/zone on the NRMCMember. The Rural Council also elects one council member from each zone to serve on the NRMCMember.

Initially CBNRM paid little attention to these sub-committees once they elected the NRMCMembers. They were not structured with elected officers or SAV and NRM committees to function at the zonal level, nor have they received any training. In FY 1999, CBNRM intends to help the sub-committees establish officers and become more involved in program activities. The sub-

committees have the advantage that they do not compete directly with the Rural Council, because they are organized at the zonal level. One likely long-term scenario after the CBNRM program ends would be for the Rural Council and NRMC to merge, and the sub-committee to take over a number of the NRMC tasks, at a level one step closer to the population.

The CBNRM program has also improved the representation of local groups, associations and GIEs through the establishment of the sub-zone level federations structures. Federations as local associations of village groups existed in the Fatick area as the result of a previous project. Organizing sub-projects there was easier than in Kaolack, where the program tried to use individual groups, village associations or GIEs to represent a multi-village area.

In the newer generation CRs, the federation is introduced from the beginning as the entity in the sub-zones that would be responsible for implementing the sub-projects. It is structured as an organization on which each of the existing groups, associations, GIEs etc. in the sub-zone has a representative. These federations are structured with elected officers and an executive board that can function as a secretariat for the purpose of implementation activities. During impact assessment team field visits, people responded that the federations have two distinct advantages: 1) they allow every group a chance to participate in the benefits of the program without spending the 40,000 FCFA necessary to become an official GIE; and 2) They provide a means to share the cost of the local contribution required by the program. In FY 1999, these federations/promoters are targeted for training related to the implementation of sub-projects as well as for technical training related to some of the NRM practices.

The federations have also been somewhat neglected by CBNRM considering the important role they must play in the organization of logistics and implementation of the sub-projects. The federation members are the closest thing to grassroots level representatives in the representative structure conceived and established by CBNRM, and the key to implementing the activities that will have both bio-physical and people-level impacts. The program could not include the federations in the workshops which designed the sub-projects because they had not yet been created. Only after the sub-projects were designed, were village groups asked in which of the 2 or 3 sub-projects developed for the zone would they like to participate. This choice determined the boundaries of the sub-zones, and only when this was known could a corresponding federation be created.

The decision to initially focus on establishing and training the NRM committees offers the potential of influencing other local institutions and the manner in which they operate, particularly the Rural Council. Nudging local institutions towards more accountable, transparent and democratic behaviors would be an important impact.

The impact assessment team would like to see CBNRM facilitate greater participation of the lower levels of the representative structures which it has created, specifically the sub-committees

and federations. This strategy is necessary because the representative structure created by CBNRM is unlikely to be perceived as truly representative of the population if the portions of that structure closer to the grassroots level are denied participation. But the impact assessment team recognizes that CBNRM had to start somewhere, and it can only do so much at one time. Developing sustainable local institutions to improve civil society is a long-term and difficult process.

- Sub-committee and federation members/promoters should also be included in the target for training similar to that provided to the NRMC members, to facilitate this larger role in program activities.
 - CBNRM should consider making the sub-committees, which include the NRMC and Rural Council members, the primary target for program training in the 3rd generation sites.
 - CBNRM should expand the roles of the sub-committees and federations in the entire range of program activities, and particularly, for example, in the planning and design of sub-projects for their sub-zones. They should also be included in the target for training similar to that provided to the NRMC members, to facilitate this larger role in program activities.
 - CBNRM should hold workshops to reconsider the sub-project designs that include the sub-committees and federations or promoters responsible for implementing the activities.
6. The intent of CBNRM is to increase community participation and promote a bottom-up approach in which communities take charge of their own development. To date, CBNRM has had very few activities and limited interaction directly with the grassroots level (village and population). Only the 42 functional literacy classes, implemented by another set of proxies/partners, really target the population as opposed to their representatives, and are producing people-level impacts. Micro-realizations did target the grassroots level, but the results were considered disappointing and have been discontinued. The sub-projects will produce some village/people-level impacts, but target federations of local associations as the representative structure with which the project interacts.

Part of the reason for CBNRM not having more direct contact is the attempt to work through representative structures (NRMCs, sub-committees and federations) adapted to the program attempt to scale-up the targeted level of intervention, from the village to the CR. However, the manner in which those representative structures were created creates a potential problem. Normally, one would expect a program with a participatory approach to work with the population to build a representative structure from the ground up towards higher level of representation; for example, starting at the village level, then the sub-zone level, the zone level, and the CR level, etc. But, CBNRM did not use such an approach. Initially they began directly by constituting the CR-level NRMC. The results were not entirely satisfactory, and in later generation sites, they facilitated the election of zonal-level sub-committees, and had those representatives elect the NRMC from among the people already elected to a sub-committee.

This is a step in the right direction, but it still is not clear if the process started close enough to the people for these representative structures to be accepted as truly representative of the population. It also raises the question whether an organization like CBNRM, that does not regularly interact at the grassroots level, is the appropriate institutional base from which to facilitate the establishment (*montage*) of structures intended to represent the population.

- In the short-and medium-term, CBNRM needs to focus more on the sub-committees and federations which are at the base of the representative structure which it has created.
 - Sub-committees should be prepared for the role of helping the NRMC implement many of its tasks at the zonal level, particularly pertaining to the roles of the SAV and GRN commissions.
 - The design of zone and sub-zone level activities should be done with the participation of the direct representatives of those levels. Sub-committee and federations should be directly involved in the design of the sub-projects that they will be responsible for implementing. They should also be more directly involved in the entire range of program activities.
7. To date, federations and sub-project promoters interact as passive consumers with vendors and service providers who have been selected by the program. Promoters need to gain experience managing service providers, including learning about the mechanics of bidding, developing and signing contracts, etc., so that they have the skills to do this on their own after the end of the program. They should be allowed to gain this practical experience in situations supervised by program representatives.
- CBNRM needs to allow the federations/promoters a larger role in the procurement of goods and services to allow them to gain experience in negotiating with and managing service providers.
8. Most if not all of the actors within the CBNRM program implementation structure face major problems of the distance and scale of their interactions. The PMU operating throughout most of southern Senegal from a single office in Dakar, and no regional representation, even though all of the target CRs are in other regions, and the majority are over 500 kms away (One might quibble about the distance to Kolda/Medina Yoro Foulah, but crossing the Gambia River on the ferry adds a time factor and logistical constraints that make the trip about as long as using the longer route through Tambacounda.). CBNRM has difficulty modeling a decentralized bottom-up participatory approach, in part because it is a completely centralized organization (and under the tutelage of a hierarchical and authoritarian institution, the Forest Service). The program would be better served by a structure in which it had a very small 1-3 person team in close proximity to 1 or 2 clusters of target CRs, where decisions could be made and support provided. This might be on a regional basis, or for example, Fatick and Kaolack might be served by a single

team. Tambacounda might require a slightly larger team, or perhaps even two teams, given the distances involved and the state of some roads. Under such an arrangement, the Dakar office would become a smaller administrative and support center, supporting the small regional teams where operational decisions would be made.

MAP of Communautés Rurales

NRMCs face varying levels of the size and distance problem. The largest target CR in Fatick and Kaolack is only 225 km². CRs in Kolda range from 623 km² to 1,858 km², and those in Kedougou from 2,268 km² to 3,505 km². In the larger CRs, with 100 villages or more scattered over hundreds or even several thousand square kilometers, there is no way for the NRMC to get the message out to all of those villages with the structure and resources available. In Kolda, NRMCs admit that some of the distant villages have never even heard of CBNRM, not to mention participate.

CERPs face the same problems as the NRMCs, further complicated in most cases by the concentration of 2-4 target CRs in the same *Arrondissement* (the administrative unit served by a CERP). There is tremendous demand for personnel support and use of the CERP vehicle to implement NRMC activities, particularly as deadlines approach, in addition to any technical activities the CERP might wish to schedule. While the Dioulé CERP staff do not admit to being overburdened, they do say that they have no idea how they can adequately serve the role expected of them by CBNRM in all 4 CRs for which it is now responsible (in addition to its normal administrative responsibilities). The CERP staff at Medina Yoro Foulah go a step further and say they could not do the job expected of them by the CBNRM program in three CRs, and their performance will fall even further short of expectations now that a 4th CR is being added.

- In the long run:
 - % Programs like CBNRM require a more decentralized organizational structure. The program would be better served by a structure in which it had a very small 1-3 person team in each region, or in close proximity to 1 or 2 clusters of target CRs, where decisions could be made and support provided.
 - % CERPs should not be given responsibility to provide technical assistance to more than two target CRs, until the program is already well underway in those two.
 - In the short-run:
 - % CBNRM should expand the roles of the sub-committees and federations in the entire range of program activities, and particularly, delegate some of the communications and monitoring tasks to these lower levels of the representative structure.
 - % CBNRM and its CR level representatives need to develop a transportation policy which does not rely as heavily on the use of the CERP vehicle for accomplishing NRMC, sub-committee and federation tasks.
9. It is nearly impossible for the SAV and GRN commissions of the NRMCs to accomplish their critical assigned tasks serving as an interface between the NRMC and the CR's population, particularly in the larger CRs, with the resources available. The NRMC members are unpaid volunteers, with families to feed. It is impractical to expect that they will spend every day out communicating with the population on behalf of the program, even if they had access to

transportation and some personal incentive to work that much. In large CRs it would take a full-time staff to contact all 100-150 villages two or three times a year. Both the NRMCS and the CERP are dependent on the use of the CERP vehicle for a number of activities, and in the large CRs with a large number of villages, having access to the vehicle once every week or two is not sufficient to accomplish their tasks.

The media section of CBNRM provide some materials to help the SAV and GRN commissions in their communications with the population to help promote program activities. However, in many respects, the focus of the media section seems to be on producing videos, which may serve an important policy function in Dakar and other urban centers, but do little to help with the critical task of communicating with the rural populations. The media section now has a media truck that can show such videos in village settings, but the impact assessment team did not find any villages who claimed to have seen such videos. To date, the CBNRM program and structure have not succeeded in providing the commissions with the means or logistical support necessary to allow them to pursue their tasks effectively.

- CBNRM needs to decentralize a number of the tasks assigned to the NRMCS, and work more directly with the sub-committees and federations. Structuring the sub-committees and empowering SAV and GRN commissions at the sub-committee level will not necessarily solve the problem, but will be an important step in the right direction.
- In the larger CRs in particular, even SAV and GRN commissions at the zone level may need access to transportation to accomplish their tasks, even if this means simply having funds to rent a horse cart on a fairly regular basis.
- The sub-committees and federations need to be targeted in training activities to increase their capacity to take on additional responsibilities.
- CBNRM needs to create tools to operationalize participatory development at the grassroots level, particularly through the sub-committees and federations. There are a wide variety of tools which can be used to help non-literate populations understand and master complicated project processes.
 - % The media section should expand its efforts to help provide some of these tools and training in their use.

10. Another important obstacle is the tendency to revert to traditional, top-down directive interaction, particularly when under pressure to implement activities over a large scale within a limited time frame. The CBNRM staff is stretched thin, must travel a long distance to implement any activity at the CR level, and needs to use its time effectively. Therefore, ordering CERPs and NRMCS to change their programming to accommodate an unplanned visit from the PMU or ACA, seems perfectly reasonable.

NRMCS and CERPs don't have the time and resources to visit all the villages. They send out word and convoke promoters, or interested persons to centrally located meetings, and then tell

them what needs to be done to meet the next deadline imposed by the program or the agricultural calendar. There is often little discussion in the meetings, and little information provided on how a particular action or request fits in the context of past activities, the LUMPs, or the priority problems and constraints raised by the population during the PRA. As a consequence, most villagers, and frequently even the promoters, have no idea how a particular action or request, relates to the development priorities of the CR, zone or sub-zone.

Another aspect of this same problem is that most of the work done under CBNRM is implemented by proxies, the NRMCS, CERPS, animators, and hired consultants. CBNRM has less control over these partners, than it would have over program staff, and can primarily influence their attitudes and behavior through training and terms of reference. Training alone may not be sufficient to overcome long-ingrained cultural norms. Furthermore, almost anyone may lose sight of the process espoused, when that intention is contradicted by the need for immediate results to meet some particular deadline.

- CBNRM should establish a participatory protocol for visits to and interactions with collaborators. This protocol should relate to PMU visits to CR-level stakeholders as well as to visits of the CR-level program representatives to the zone, sub-zone or village, and include:
 - % A clear statement of visit objectives to all concerned stakeholders;
 - % The relationship of this visit and objective to recent program activities and processes and overall program objectives. PMU and CR level representatives should consult the archives of the organization being visited to review the processes to date, and how the current visit will further the objectives.
 - % Taking the role of a facilitator: promoting discussion and analysis which helps the organization being visited to find its own solutions, rather than imposing an answer from the outside.
 - % Record the visit in the organizations guest book and on tape if necessary.
- Adherence to such protocols should become part of the criteria for evaluating the performance of individual staff and program partners.

11. To date, CBNRM has avoided becoming too involved in some very important local situations because of their political overtones. The most obvious case is that of the Pata Forest in the Kolda region. Residents of the Pata and Ndorna CRs where the forest is located, expressed extreme frustration at the colonization of the Pata Forest by immigrants from the Sine Saloum. These environmental refugees from the north are clear cutting large areas in the forest for cultivation.⁴⁴ The forest is a protected area (forêt classée) which the local population has maintained for 40 years, and on which they depend for grazing their livestock. Much of the area

⁴⁴ Gray Tappen says that satellite observations indicate that 28.8 percent of the Pata forest has been cleared, personal communication, 3/16/99.

and even many of the water sources in the forest are no longer accessible to their livestock. Residents say that there is enough uncultivated land in Kolda, that immigrants could easily find areas to farm, if they went through the traditional process of negotiating with the local villages/chiefs/population. Residents say that the Forest Service and officials in Dakar are involved in providing these immigrants with “papers” which appear to authorize their settlement in the forest. There probably is no legal basis for these “papers” because no one except the President has the right to authorize settlement in a protected area. Still, no one at the local level has the power or means to challenge these false “papers”. They have asked the Forest Service and other local government officials to help them protect the forest, but no one will take any action. Leaving a meeting with one of the NRMC’s, a member warned:

The Senagalese Government now calls this area Kolda, but remember, it is still part of the Casamance.

The warning seems clear. People in Kolda are seriously considering joining the Casamance rebellion because of issues like this one, and the intransigence of government officials in the face of their complaints.⁴⁵

The warning also seems clear for CBNRM: it can’t avoid the political issues, and also remain relevant to the needs and preoccupations of the population. NRMC members said:

CBNRM is slowly, after long delays, trying to help us organize to plant a few trees. How can we take a program seriously, that claims to be a NRM program, that focuses on planting a few trees, but won’t help us save our forest, where these immigrants are cutting a thousand trees a day.

- CBNRM should get involved in the Pata Forest issue and be an advocate before the Forest Service and the Ministry of Environment and Protection of Nature for addressing and finding a settlement of this issue.
- CBNRM should use its media section to prepare an audio-visual documentary on the situation in the Pata Forest for TV and radio diffusion.

1.5 CBNRM Design Problems

The CBNRM program has several important design problems:

⁴⁵ In the final days of the mission, the MEPN appointed a committee to investigate the situation. It reported that indigenous groups were forming armed civil protection forces and that one chief of a immigrant village had been shot and killed.

12. The CBNRM program was designed within the context of structural adjustment and the government's disengagement from providing rural services. The lack of any provision to help local populations obtain access to credit seems to be a major design flaw. Individuals and groups would typically prefer to pay for activities through credit, than receive a subsidy that requires a large up-front financial contribution. Also the population prefers programs that provide access to a stream of revenue, rather than a one-shot event. They realize that a credit program provides the possibility of engaging in additional activities in the future, whereas, subsidies usually do not.

The project is unlikely to achieve significant bio-physical and people-level impact if it does not reach some critical mass of the target population, which probably means facilitating access to credit in the short-and medium term, and a longer life-of-program. If USAID/Senegal wants CBNRM and future related programs to have bio-physical and people-level impact and increase incomes, it will have to find some way to provide the target population with the basic enabling conditions for productive and profitable agriculture activities, particularly access to credit and other basic rural services. Village groups/associations/coops with access to credit and trained in functional literacy (including numeracy) and financial management have demonstrated the capacity to initiate the provision of some of these services in a profitable manner.⁴⁶

- USAID programming needs to consider structural adjustment and its impact on the existence of enabling conditions for income-generating activities, particularly in the rural sector.
- In the meantime, USAID needs to explore ways to make basic rural services, particularly credit, available to populations targeted by programs like CBNRM if it wants these programs to succeed in developing people-level impacts, and increase rural income.
- USAID programming should explore the synergies between SO1 and SO2 type programs, and the ability of rural/village coops to provide basic rural services.

13. The failure to recognize that credit would be necessary in the program design is closely related to the acceptance of the matching grant approach as both the incentive and the means to finance NRM activities. The SRP Final Evaluation report concluded that the matching grant approach was not appropriate for the CBNRM CR program, and recommended that it not be used by CBNRM in that context. Although the SRP evaluation team appears at times to be a little uncertain about this conclusion and recommendation, the fact that the originally perceived success of the matching grant approach depended on the support of other projects was clear:

“Thus, matching grants relied on these other projects to provide technical assistance, credit, extension, and supervision to farmers and rural groups interested in tree planting. Matching grants, therefore, could not stand alone and had to be piggy-backed or grafted on to projects

⁴⁶ Primarily in the Africare/ KAED program.

and activities that provided the requisite framework. It is important to understand that without these other activities, the enabling conditions would not have been in place and matching grants could not have had the expected participation rate and impact.”⁴⁷

Unfortunately, CBNRM does not have a NRM project in each CR to provide these services and CBNRM and its local representatives do not have (have not been provided with) the structure and capacity to provide this framework themselves. It would seem that the prognosis of the SRP Final Evaluation team has been largely born out by the micro-realization experience. It does not appear that the matching grant approach alone will be much more successful in delivering bio-physical and people-level impact in the context of the sub-project approach.

Closely related to the matching grant question is the issue of *de facto* using a narrow definition of NRM practices.⁴⁸ Of necessity, SRP and CBNRM established their definition of NRM on the basis of what NRM practices they would subsidize under the matching grant program. The rationale for such subsidies was to provide the rural population an incentive to adapt practices which were not profitable in the short-term. This has resulted in a restricted definition which does not include many NRM related income-generating activities (gardening, animal fattening, tree nurseries, cereal banks, cereal mills, etc.) or those related to infrastructure, particularly for water. This definition question has hindered CBNRM from addressing many of the problems and potential solutions developed in the LUMPs. Thus the design on one hand insists that CBNRM follow a participatory process to develop LUMPs, and on the other hand, places CBNRM in a position from which it is difficult to respond to the demand-driven priorities which are identified in those plans. Furthermore, divorcing NRM practices from the income-generating activities raises issues concerning the relevance of the NRM practices to the real priorities of the target population.

- Greater distinction should be drawn between activities which focus on public goods, and those intended to primarily benefit individuals and small groups.
- Future programs should not use the matching grant approach for activities which target individuals, unless the program can be expanded to accommodate all households willing to participate.
- The distinction between NRM and income-generating practices should largely be eliminated for activities which target either individuals or small local groups. Limited

⁴⁷ Michael Fuchs-Carsch et al. 1995. Final Evaluation of the Senegal Reforestation Project, p. 8.

⁴⁸ The CBNRM staff does not believe that it has a narrow definition of NRM practices, or that participants are even limited to the list of 17 practices which are identified as qualifying for matching grants. Field surveys indicate that participants often feel that they were limited to a very small number of options by program representatives, either explicitly, or because no provision has been made to support other options. For example many farmers claim that they wanted to plant local species but were told that eucalyptus were the only species for which the Forest Service nurseries had seedlings available.

progress can be expected on the NRM front if there is no support for the income-generating activities which the NRM activities should be supporting.

- The matching grant approach should be largely restricted to promoting activities which focus on public goods.
- NRM activities for rural producers should be viewed largely in the context of enhancing or maintaining income streams from income generating activities.
- CBNRM should experiment this new approach in its 3rd generation CRs, where field interventions have not yet begun.

14. The structure of the CBNRM program is at odds with the intended purpose of the program. CBNRM is intended to help implement the government's decentralization strategy but is designed as a totally centralized organization. The completely centralized structure of CBNRM's PMU contradicts what the project is trying to promote. The program itself, can not model the decentralization concept, or how it might work.

The institutional location of CBNRM under the tutelage of the Forest Service adds to the contradiction. The Forest Service is by nature rather hierarchical and authoritarian, given its para-military history. While that has changed some in recent years, most villagers interviewed have not seen a major difference in the behavior of forestry agents. Fostering participatory bottom-up approaches when under the influence of an authoritarian and top-down institution is very difficult, and the present institutional location is far from ideal, given the objectives of the program.

Furthermore, the centralized structure is impractical, given that the majority of target CRs are 500 km or more from the program office in Dakar. Many of the program's operational problems are related to this structure and the distances between the program office and the intervention sites. In cases where an unplanned action must be taken quickly by the PMU staff to facilitate program implementation, the number of CRs and the distances between them simply overwhelm the program.

- In the long run, future programs should have a decentralized structure, and to the extent possible, be associated with a less hierarchical and authoritarian institution.
- A single regional base in the Tambacounda area might help to significantly reduce some of the operational problems related to target areas near Tambacounda, Bakel, Kedougou, and Kolda. However, such a solution is still far from modeling decentralization. Establishing a small CBNRM staff team for each region, or perhaps to be responsible for two clusters of target CRs, would help improve the timeliness of program decision-making.
- The program needs to review the decision-making processes and determine where the responsibility for decisions can be delegated to program representatives such as the NRMCs and CERPs.

- The PMU should avoid assuming greater responsibility for direct delivery of field services and should instead improve the CR-level technical and participatory development capacity.

1.6 CBNRM Relationship to USAID/Senegal

15. The recent history of relationships between USAID/Senegal and CBNRM has been a case study in how not to manage a program. The CBNRM program has had a very mixed relationship with the USAID/Senegal Mission. It was reportedly the favored program under the old Country Program Strategic Plan (CPSP), but became an orphan under the new CSP, even though it was the only program in progress related to either SO1 or SO2. The reorganization of the Mission into new SO teams resulted in the firing half of the old AG/NRM SO team, and the dispersion of the rest to other activities. SO2 became responsible for managing CBNRM, but would not talk to the CBNRM staff because of the potential conflict of interest introduced when CBNRM deposited its unsolicited proposal to extend its PACD and continue operating throughout the life of the new CSP. CBNRM needed to resolve the issue of USAID authorizing a credit or credit guarantee fund to get on with program implementation, but could not get a response from USAID concerning the issue.

With the dissolution of the old AG/NRM SO team, CBNRM staff had difficulty finding anyone who would talk to them and who could make an official decision for USAID concerning the operational issues at hand. SO1 is responsible for credit, but would not talk to CBNRM or even attend internal USAID meetings concerning CBNRM, apparently because that program was the responsibility of SO2. Yet SO2 was not authorized to make a decision about credit, etc. Apparently, no official meetings were held between CBNRM and USAID between June and December 1998. When a meeting was finally held in December 1998, perhaps 20 USAID staff were present, each raising different issues, and many of the statements being made contradicted what had been said by other USAID staff. CBNRM staff left that meeting with no idea what USAID wanted the program to do, because USAID obviously had no coherent strategy itself.

- USAID needs to establish a small 4-5 person steering committee to coordinate the USAID position and interactions with CBNRM. This committee might consist of one person each from SO1, SO2, AME, and the head office. All official Mission positions and requests should be communicated through this steering committee, and CBNRM positions and requests should be communicated to this committee. Committee members should meet regularly with CBNRM program staff and be available to them to discuss the work plan and other operational issues.

CBNRM is already addressing or facing many of the issues that will be faced by new democracy and governance programs and new programs for small scale enterprise and income generation. CBNRM, SO1 and SO2 would all benefit from a forum in which issues can be raised in a collaborative environment, rather than an environment of evaluation and criticism.

- It would be useful to organize a regular, or an occasional, issues oriented forum in which both experience and concepts could be discussed in a collegial environment.

1.7 CBNRM Operational Problems

CBNRM has had a number of operational problems over the years, particularly in the first generation CRs. In many cases, procedures have been improved based on the lessons learned in these first generation CR experiences. Some of these problems were caused by program actions and others were exogenous to the program. Some continue and need to be addressed.

16. CBNRM had a difficult problem managing expectations in the 1st generation CRs. One of the problems was the sous-prefet who introduced the program in one of the regions by announcing that CBNRM was an 18 billion FCFA program, and asking the local population if they knew how much a billion was.⁴⁹

The manner in which PRAs were implemented and presented to the population also contributed to these exaggerated expectations, particularly in the 1st generation CRs. PRA teams report using 7 or 8 of the PRA tools, but using only one tool in each of 7-8 different villages. No individual village or group went through an entire PRA process of identifying problems and potential solutions and selecting priorities among those problems and proposed solutions. Many villagers surveyed did not even realize that they had been involved in the process.

CBNRM changed the process in recent generation sites. After training the NRMCS, the group of about 30 NRMCS members, CERP staff and consultants divided into 8-12 small (2-3 person) teams and each team spent 8-10 days in a single location. These locations usually consisted of central villages or one site where people from several local villages met to participate. With this many teams, there were several sites to aggregate to identify priority problems and potential solutions in each zone, and then the zonal results to aggregate to form the CR-level PRA results.

⁴⁹ In village surveys, the impact assessment team heard stories of people taking sacks to program meetings, because they could not imagine how a program was going to spend that much money without just handing out large sums of cash.

Frequently the 15 year LUMPs are still too much of a wish list of things the population would like to have done for them, rather than a careful consideration of what the local population would do to take charge of its own development, and the kinds of assistance that would be needed in order for them to take charge. The PRA teams (often consisting of a marginally trained NRMC member and a consultant, who in some cases is a university student) were not able to facilitate that deeper level of involvement and conceptualization on the part of the population. But at least people remembered the experience, knew about the LUMP, and commented proudly upon their having participated in the identification of the problems and proposed solutions identified in the LUMP. To facilitate a careful consideration on the part of the population requires strong facilitation/trainer skills in addition to knowledge of the PRA process. The need for this skill has not been reflected in the criteria used for the selection of consultants participating in the PRAs and preparing the LUMPs, or part of the training program for NRMC members prior to participating in the PRAs.

In the 1st generation CRs, the PRA teams compounded the problems of the population's expectations by scheduling the implementation of the entire wish list (intended to cover 15 years of development activity) over a 3 year period, rather than identifying and scheduling only the priority NRM activities which the CBNRM program might fund over those 3 years. People who saw the LUMP, expected that the entire wish list would be implemented during the 3 year period as scheduled in the LUMP, and that the entire thing would be financed by CBNRM. In recent generations PRA teams appear to be more careful of what they schedule in the 3 year period, and what they imply will be financed by the program.

In recent generations, CBNRM has begun to produce some fairly useful regional plans at the CR level which include a strong NRM/environmental component. Although primarily focused on common village lands with only limited attention to protected areas, the approach bears some similarities to Landscape Ecology. Given the progress in overcoming the problems CBNRM originally experienced, it has learned some lessons which might be of interest to programs in other countries, function in this domain.

- Facilitation/trainer skills should be included in the criteria for field level personnel used by consultants in the implementation of the PRAs and preparation of the LUMPs and included among the skill taught to NRMC members.
- It would be helpful if program representatives continued to do occasional PRA type activities at the village level to monitor program activities and changes in attitudes among the population.
- It would be mutually beneficial if an exchange could be organized between CBNRM and programs in other countries responsible for regional planning and landscape ecology.

17. During the FY 97 and FY 98 growing seasons, many of the reforestation activities received their seedlings for planting at the very end of the rainy season. In several cases, only a single rain

followed the planting of the trees and most if not all were lost. Part of the problem may be exogenous to CBNRM in that some nurseries apparently target outplanting on National Tree Day in early August, which is already too late in the season to achieve good results. It looks like CBNRM and the participants may face the same problem again in FY 99, given the delays concerning the credit issue and the difficulty collecting the financial contributions for the sub-projects.

In a number of cases, farmers involved in tree planting activities under the micro-realization program reported that they were discouraged from using particular species or unable to do so because the species were not available in the nurseries.

- CBNRM needs to develop a calendar of when nurseries must be started based on a date for planting the seedlings early in the rainy season. If seedlings can not be delivered by an appropriate (early rainy season) planting date, the activity should be postponed, rather than wasting the time and the investment of the participants on an activity that has little chance of success.
- Nursery operators should be encouraged to provide a range of tree species to local growers. The program should consider facilitating access to seed from a wider range of species.

18. CBNRM has a highly-centralized decision-making process, particularly with regard to the design and approval of sub-projects. This tendency to make most decisions at the level of the PMU is at least in part due to a lack of confidence in the proxies (the NRMCS, CERPs and animators) that the program works through at the CR level. In a number of cases this tendency is demonstrated by the PMU assuming greater responsibility for direct delivery of field services, apparently out of fear that it won't be handled correctly. The tendency to have PMU staff involved in details of service delivery and most decisions is neither operationally efficient nor empowering in the long-term.

- The program needs to review the decision-making processes and determine where the responsibility for decisions can be delegated to partners and decentralized program representatives.
- The PMU should avoid assuming greater responsibility for direct delivery of field services and should instead improve the CR-level technical and participatory development capacity.

19. Villagers, and even promoters, say in field interviews that they do not know what to expect from CBNRM, that they don't receive enough information, and what information they do receive from the program and its local representatives often presents mixed signals. This was evident in the fact that many villagers in the 1st generation CRs did not know that the program had changed from the micro-realization approach to the sub-project approach. Even if aware of the sub-projects,

many thought or at least hoped that they would still receive cash payments for surviving trees. Many also thought that they would have access to credit for the program activities planned for the FY 99.

- CBNRM needs to make more information available to local participants in a form that they can use and understand. Important program documents need to be made available to participants in local languages, in both written and “spoken” form, i.e., recorded on cassettes. This should also include program agreements, all contracts, descriptions of important program initiatives and policy statements, summaries of interactions between program representatives at different levels and the clients with whom they interact, meeting minutes, etc.
 - % Under current law, contracts written in local languages may not be legally binding. In this case it may be necessary to prepare contracts in both the local language and French with the understanding that the French version will take precedent over the local language version in the case of legal procedures.
- At a minimum, such “spoken documents” should be provided to the sub-committees and federations or associations. They in turn should be encouraged and provided the equipment (tape recorder and cassettes) to provide similar documentation to their own clientele.
- The program should establish a participatory protocol for visits to and interactions with collaborators. This protocol should relate to PMU visits to CR-level stakeholders as well as the visits of CR-level program representatives to the zone, sub-zone or village, and include:
 - % A clear statement of the visit objectives;
 - % The relationship of this visit and objective to recent program activities and processes and overall program objectives. PMU and CR level representatives should consult the archives of the organization being visited to review the processes to date, and how the current visit will further the objectives.
 - % Promoting discussion and analysis which helps the organization being visited to find its own solutions, rather than imposing an answer from the outside; take a facilitators role.
 - % Record the visit in the organizations guest book and on tape if necessary.

20. On a closely related issue, promoters and others involved with the program do not receive sufficient financial records from program representatives to maintain transparent accounting and financial records. One of CBNRM’s successes is creating a system of transparent accounting and financial management at the NRMC level. However, the program and its local representatives do not appear to provide promoters with sufficient financial records that they have the possibility of maintaining transparent accounting and financial management of their own.

- CBNRM and its local representatives need to provide promoters and others more accounting information and financial records, also in local languages or arabic.

1.8 Conclusions and Recommendations

1.8.1 Participation and people-level impacts

1. Without access to credit to expand participation to include some critical mass, the bio-physical outputs and people-level impacts of the sub-projects, will remain quite modest, particularly relative to the size and the populations of the CRs, even if all of the sub-projects planned for the life-of-the-program are successfully completed. If people-level impacts are weak, the program risks being rejected by stakeholders, as not meeting their needs and expectations. If the stakeholders do not buy-in to and internalize the program's NRM objectives, there will be little sustainable NRM impact. The positive achievements in governance, risk being disregarded or repudiated because CBNRM did not respond to stakeholders overriding needs.

The sub-projects were designed without the participation of the promoters/federations who are intended to implement them and without other grassroots-level representatives such as the zonal sub-committees. This would appear to compromise the chances that the population or even the organizations intended to implement the sub-projects will buy in to their objectives, without which, there will be little sustainable impact.

Given these two issues, the sub-projects as presently constituted, do not appear to be a particularly effective means of achieving program objectives.

Recommendations:⁵⁰

- CBNRM should take another look at sub-project designs, with the full participation of the relevant sub-committees and federations/promoters.
- CBNRM should do a mid-term evaluation of the sub-project approach and its impact, particularly in light of the non-accessability of credit to participants.
- CBNRM should explore linkages with programs that do focus their interventions and interactions at the grassroots level, and can help provide people-level impacts, for example, enterprise development programs such as those being formulated under SO1.
- CBNRM should consider developing some easy-access collaborative activities to complement the participatory approach, increase people-level impacts, and allow some

⁵⁰ Recommendations will appear as bulleted items using the diamond bullet.

“quick victories” in which the population reaps some benefits from collaborating with the program in the short-run.

- CBNRM should test some of these recommended approaches in the 3rd generation CRs.
2. Kadd does not presently grow throughout the entire CBNRM intervention zone, and there is no one activity that will provide a “quick victory” or (*porte d’entrée*) throughout the entire zone. However, the Jig Jam protection scheme, the “seeds for trees” program, and training women to construct improved cook stoves are the types of activities that promise to provide a “quick victory” for programs like CBNRM, and potentially greater people-level impact than the sub-projects, at lower cost. The NRMCC, sub-committee and federation structure would seem to lend itself particularly well to the type of land use management activity which Jig Jam initiated in the Fissel CR.
 - CBNRM should consider developing some of this type of “quick victory” activities as complementary to, or substitutes for, the present sub-project program, particularly in the 3rd generation sites.
 3. Basic agricultural services such as access to: credit, agricultural inputs such as improved seeds and fertilizer, transportation, marketing and extension services are not generally available to rural populations in Senegal. For CBNRM, access to credit is the most obvious condition necessary to enable its sub-project strategy to provide people-level impacts. Without these enabling condition, the link between exploiting natural resources and increased private sector incomes is tenuous, CBNRM will be impeded from making an important contribution to rural incomes, and it may have to change its strategy as addressed above. USAID/Senegal must share the burden of this deficiency, since the national situation existed at the time of program design, and CBNRM has attempted to work with USAID/Senegal to address this problem.
 - USAID and CBNRM may need to address changing the goal level objective to something that is more realistic under existing conditions.
 4. The decision to initially focus on establishing and training the NRM committees offers the potential of influencing other local institutions and the manner in which they operate, particularly the Rural Council. Nudging local institutions towards more accountable, transparent and democratic behaviors would be an important impact.

The impact assessment team would like to see CBNRM facilitate greater participation of the lower levels of the representative structures which it has created, specifically the sub-committees and federations. This strategy is necessary because the representative structure created by CBNRM is unlikely to be perceived as truly representative of the population if the portions of that structure closer to the grassroots level are denied participation. But the impact assessment team recognizes that CBNRM had to start somewhere, and it can only do so much at one time.

Developing sustainable local institutions to improve civil society is a long-term and difficult process.

- CBNRM should target the Rural Council for training similar to that provided to the NRMC members.
 - CBNRM should not voluntarily disband the NRMCS unless there is significant progress on the part of the Rural Councils, towards becoming more representative of the different groups that make up civil society in the CR.
5. The effective training provided to the NRMCS has not trickled down to the sub-committee and federation level. These organizations, which are responsible for actually implementing the project's NRM and income-generating activities, have not received any capacity enhancement to date (although some limited training is scheduled for FY 99). The sub-committees have the advantage that they do not compete directly with the Rural Council, because they are organized at the zonal level. One likely long-term scenario after the CBNRM program ends would be for the Rural Council and NRMC to merge, and the sub-committee to take over a number of the NRMC tasks, at a level one step closer to the population. All NRMC members are members of sub-committees, all Rural Council members are members of the sub-committee where they reside, and many of the federation members are also members of the sub-committees. A focus on the sub-committee would cover most of the representative structure created by CBNRM.
- Sub-committee and federation members/promoters should also be included in the target for training similar to that provided to the NRMC members, to facilitate this larger role in program activities.
 - CBNRM should consider making the sub-committees, which include the NRMC and Rural Council members, the primary target for program training in the 3rd generation sites.
 - CBNRM should expand the roles of the sub-committees and federations in the entire range of program activities, and particularly, for example, in the planning and design of sub-projects for their sub-zones. They should also be included in the target for training similar to that provided to the NRMC members, to facilitate this larger role in program activities.
 - CBNRM should hold workshops that include the sub-committees and federations or promoters responsible for implementing the activities to reconsider the sub-project designs.
6. CBNRM has very few activities and limited interaction directly with the grassroots level (village and population). Part of the reason for CBNRM not having more direct contact is the attempt to work through representative structures (NRMCS, sub-committees and federations) adapted to the program strategy to scale-up the targeted level of intervention, from the village to the CR. One might be fairly confident that the structures were acceptable to the population if they had developed from the ground up, through a grassroots, town meeting type, participatory process.

The fact that they were conceived by outsiders and established in a somewhat top-down manner raises the critical issue of whether they will be seen as representative of the population in the long run. It also raises the issue of whether an organization like CBNRM, that lacks such grassroots level interaction, is the appropriate institutional base for facilitating the establishment (*montage*) of those representative structures.

- In the short-and medium-term, CBNRM needs to focus more on the sub-committees and federations which are at the base of the representative structure which it has created.
 - Sub-committees should be prepared for the role of helping the NRMC implement many of its tasks at the zonal level, particularly pertaining to the roles of the SAV and GRN commissions.
 - The design of zone and sub-zone level activities should be done with the participation of the direct representatives of those levels. Sub-committee and federations should be directly involved in the design of the sub-projects that they will be responsible for implementing. They should also be more directly involved in the entire range of program activities.
7. Promoters need to acquire the skills to manage service providers, including gaining experience in the mechanics of bidding, developing and signing contracts. The practical experience and confidence to handle such situations should be gained in collaboration with program representatives.
- CBNRM needs to allow the federations/promoters a larger role in the procurement of goods and services to allow them to gain experience in negotiating with and managing service providers.
8. Most if not all of the actors within the CBNRM program implementation structure face major problems of the distance and scale of their interactions. The PMU is trying to operate throughout most of southern Senegal from a single base in Dakar, and the majority of the target CRs are 500 kms or more from the base. In the larger CRs, with 100 villages or more scattered over hundreds or even several thousand square kilometers, there is no way for the NRMC to get the message out to all of those villages with the structure and resources available. CERPs face problems similar to the NRMCS, further complicated in most cases by the concentration of 2-4 target CRs in their zone of intervention. These problems of distance and scale, are after all, one of the primary reasons for decentralization.
- In the long run:
 - % Programs like CBNRM require a more decentralized organizational structure. The program would be better served by a structure in which it had a very small 1-3

person team in each region, or in close proximity to 1 or 2 clusters of target CRs, where decisions could be made and support provided.

% CERPs should not be given responsibility to provide technical assistance to more than two target CRs, until the program is already well underway in those two.

- In the short-run:

- % CBNRM should expand the roles of the sub-committees and federations in the entire range of program activities, and particularly, delegate some of the communications and monitoring tasks to these lower levels of the representative structure.

- % CBNRM and its CR level representatives need to develop a transportation policy which does not rely as heavily on the use of the CERP vehicle for accomplishing NRM, sub-committee and federation tasks.

9 It is nearly impossible for the SAV and GRN commissions of the NRMCs to accomplish their assigned tasks with the resources available, particularly in the large CRs.

- CBNRM needs to decentralize a number of the tasks assigned to the NRMCs, and work more directly with the sub-committees and federations. Structuring the sub-committees and empowering SAV and GRN commissions at the sub-committee level will not necessarily solve the problem, but will be an important step in the right direction.

- In the larger CRs in particular, even SAV and GRN commissions at the zone level may need access to transportation to accomplish their tasks, even if this means simply having funds to rent a horse cart on a fairly regular basis.

- The sub-committees and federations need to be targeted in training activities to increase their capacity to take on additional responsibilities.

- CBNRM needs to create tools to operationalize participatory development at the grassroots level, particularly through the sub-committees and federations. There are a wide variety of tools which can be used to help non-literate populations understand and master complicated project processes.

- % The media section should expand its efforts to help provide some of these tools and training in their use.

10. Another important obstacle is the tendency to revert to traditional, top-down directive interaction, particularly when under pressure to implement activities over a large scale within a limited time frame. There is often little discussion in the meetings between program representatives and the grassroots level population. Little information is provided on how a particular action or request fits in the context of past activities, the LUMPs, or the priority problems and constraints raised by the population during the PRA. As a consequence, most villagers, and frequently even the promoters, have no idea how a particular action or request, relates to the development priorities of the CR, zone or sub-zone.

Most of the work done under CBNRM is implemented by proxies, the NRMCS, CERPS, animators, and hired consultants. CBNRM has less control over these partners, than it would have over program staff, and can primarily influence their attitudes and behavior through training and terms of reference. Training alone may not be sufficient to overcome long-ingrained cultural norms.

- CBNRM should establish a participatory protocol for visits to and interactions with collaborators. This protocol should relate to PMU visits to CR-level stakeholders as well as to visits of the CR-level program representatives to the zone, sub-zone or village, and include:
 - % A clear statement of visit objectives to all concerned stakeholders;
 - % The relationship of this visit and objective to recent program activities and processes and overall program objectives. PMU and CR level representatives should consult the archives of the organization being visited to review the processes to date, and how the current visit will further the objectives.
 - % Taking the role of a facilitator: promoting discussion and analysis which helps the organization being visited to find its own solutions, rather than imposing an answer from the outside.
 - % Record the visit in the organizations guest book and on tape if necessary.
- Adherence to such protocols should become part of the criteria for evaluating the performance of individual staff and program partners.

11. To date, CBNRM has avoided becoming too involved in some very important local situations because of their political overtones. The most obvious case is that of the Pata Forest in the Kolda region. CBNRM can not avoid the political issues and also remain relevant to the needs and preoccupations of the population.

- CBNRM should get involved in the Pata Forest issue and be an advocate before the Forest Service and the Ministry of Environment and Protection of Nature for addressing and finding a settlement of this issue.
- CBNRM should use its media section to prepare an audio-visual documentary on the situation in the Pata Forest for TV and radio diffusion.

1.8.2 Program Design Problems

12. The CBNRM program was designed within the context of structural adjustment and the government's disengagement from providing rural services. The lack of any provision to help local populations obtain access to credit seems to be a major design flaw. The project is unlikely to achieve significant increases in income for a critical mass of rural residents in its absence. If USAID/Senegal wants CBNRM and future related programs to have bio-physical and people-level impact and increase incomes, it will have to find some way to provide the target population with the basic enabling conditions for productive and profitable agriculture activities, particularly access to credit and other basic rural services. Village groups/associations/coops with access to credit and trained in functional literacy (including numeracy) and financial management have demonstrated the capacity to initiate the provision of some of these services in a profitable manner.⁵¹

- USAID programming needs to consider structural adjustment and its impact on the existence of enabling conditions for income generating activities, particularly in the rural sector.
- In the meantime, USAID needs to explore ways to make basic rural services, particularly credit, available to populations targeted by programs like CBNRM if it wants these programs to succeed in developing people-level impacts, and increase rural income.
- USAID programming should explore the synergies between SO1 and SO2 type programs, and the ability of rural/village coops to provide basic rural services.

13. The failure to recognize that credit would be necessary in the program design is closely related to the acceptance of the matching grant approach as both the incentive and the means to finance NRM activities. The SRP Final Evaluation report concluded that the matching grant approach was not appropriate for the CBNRM CR program, and recommended that it not be used by CBNRM in that context. It would seem that the prognosis of the SRP Final Evaluation team has been largely born out by the CBNRM experience with the micro-realization activities. It does not appear that the matching grants will be any more successful in delivering bio-physical and people-level impact to a critical mass of villagers in the context of the sub-project approach.

The use of a very narrow definition of NRM practices has hindered CBNRM from addressing many of the problems and potential solutions developed in the LUMPs. This narrow definition results from the need to identify which interventions would receive subsidies under the matching grant program, and in which the rationale for subsidies was to provide the rural population an incentive to adapt practices which were not profitable in the short-term. Thus the design on one hand insists that CBNRM follow a participatory process to develop LUMPs, and on the other hand, places CBNRM in a position from which it is difficult to respond to the demand-driven

⁵¹ Primarily in the Africare/ KAED program.

priorities which are identified in those plans. Divorcing NRM practices from the income-generating activities dissociates the NRM practices from the real priorities of the target population. It also appears that the matching grant system is biased against low cost practices like natural regeneration, because there is essentially no material and equipment cost to subsidize.

- Greater distinction should be drawn between activities which focus on public goods, and those intended to primarily benefit individuals and small groups.
- Future programs should not use the matching grant approach for activities which target individuals, unless the program can be expanded to accommodate all households willing to participate.
- The distinction between NRM and income-generating practices should largely be eliminated for activities which target either individuals or small local groups. Limited progress can be expected on the NRM front if there is no support for the income-generating activities which the NRM activities should be supporting.
- The matching grant approach should be largely restricted to promoting activities which focus on public goods.
- NRM activities for rural producers should be viewed largely in the context of enhancing or maintaining income streams from income generating activities.
- CBNRM should experiment this new approach in its 3rd generation CRs, where field interventions have not yet begun.

14. The structure of the CBNRM PMU is at odds with the intended purpose of the program. Although CBNRM is intended to operationalize the government's decentralization strategy, it is designed as a totally centralized organization. It has one office in Dakar, and no regional representation, even though all of the target CRs are in other regions, and the majority are 500 kms or more distant. CBNRM has difficulty modeling a decentralized, bottom-up, participatory approach, given its own centralized structure and its institutional location under the tutelage of the Forest Service, which although trying to change, remains somewhat hierarchical and authoritarian in nature.

Furthermore, the centralized structure is impractical, given that the majority of target CRs are 500 km or more from the program office in Dakar. Many of the programs operational problems are related to this structure and the distances between the program office and the intervention sites. In cases where an unplanned action must be taken quickly by the PMU staff to facilitate program implementation, the number of CRs and the distances between them simply overwhelm the program.

- In the long run, future programs should have a decentralized structure, and to the extent possible, be associated with a less hierarchical and authoritarian institution.
- A single regional base in the Tambacounda area might help to significantly reduce some of the operational problems related to target areas near Tambacounda, Bakel,

Kedougou, and Kolda. However, such a solution is still far from modeling decentralization. Establishing a small CBNRM staff team for each region, or perhaps to be responsible for two clusters of target CRs, would help improve the timeliness of program decision-making.

- The program needs to review the decision-making processes and determine where the responsibility for decisions can be decentralized.
- The PMU should avoid assuming greater responsibility for direct delivery of field services and should instead improve the CR-level technical and participatory development capacity.

1.8.3 CBNRM Relationship to USAID/Senegal

15. The internal restructuring of USAID/Senegal seems to have destroyed any sense of managing the CBNRM program for success.

- USAID needs to establish a small 4-5 person steering committee to coordinate the USAID position and interactions with CBNRM. This committee might consist of one person each from SO1, SO2, AME, and the head office. All official Mission positions and requests should be communicated through this steering committee, and CBNRM positions and requests to this committee. Committee members should meet regularly with CBNRM program staff and be available to them to discuss the work plan and other operational issues.
- It would be useful to organize a regular, or an occasional issues oriented forum in which both experience and concepts could be discussed in a collegial environment.

1.8.4 CBNRM Operational Problems

16. CBNRM has not always succeeded in managing unrealistic expectations of the local population. The manner in which the PRAs and LUMPs were done in the 1st generation sites contributed to these unrealistic expectations. The process has improved in later generations, but the management of expectations still needs improving. There is still a concern that the 15 year LUMP is based on a wish list of everything the participants would like to have done for them, and not a careful consideration of what the local population would do to take charge of its own development, and the kinds of assistance that would be needed in order for them to take charge. To accomplish this careful consideration requires that the PRA team have strong facilitation/trainer skills in addition to knowledge of the PRA process. The need for this skill has not been reflected in the criteria used for the selection of consultants participating in the PRAs and preparing the LUMPs, or part of the training program for NRMC members prior to participating in the PRAs.

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- Facilitation/trainer skills should be included in the criteria for field level personnel used by consultants in the implementation of the PRAs and preparation of the LUMPs and included among the skill taught to NRMC members.
- It would be helpful if program representatives continued to do occasional PRA type activities at the village level to monitor program activities and changes in attitudes among the population.
- It would be mutually beneficial if an exchange could be organized between CBNRM and programs in other countries responsible for regional planning and landscape ecology.

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- The program needs to review the decision-making processes and determine where the responsibility for decisions can be delegated to partners and local program representatives.
 - The PMU should avoid assuming greater responsibility for direct delivery of field services and should instead improve the CR-level technical and participatory development capacity.
19. Villagers, and even promoters, say in field interviews that they do not know what to expect from CBNRM, that they don't receive enough information, and what information they do receive from the program and its local representatives often presents mixed signals.
- CBNRM needs to make more information available to local participants in a form that they can use and understand. Important program documents need to be made available to participants in local languages, in both written and "spoken form", i.e., recorded on cassettes. This should also include program agreements, all contracts, descriptions of important program initiatives and policy statements, summaries of interactions between program representatives at different levels and the clients with whom they interact, meeting minutes, etc.
 - % Under current law, contracts written in local languages may not be legally binding. In this case it may be necessary to prepare contracts in both the local language and French with the understanding that the French version will take precedent over the local language version in the case of legal procedures.
 - At a minimum, such "spoken documents" should be provided to the sub-committees and federations or associations. They in turn should be encouraged and provided the equipment (tape recorder and cassettes) to provide similar documentation to their own clientele.
 - The program should establish a participatory protocol for visits to and interactions with collaborators. This protocol should relate to PMU visits to CR-level stakeholders as well as the visits of CR-level program representatives to the zone, sub-zone or village.
20. On a closely related issue, promoters and others involved with the program do not receive sufficient financial records from program representatives to maintain transparent accounting and financial records.
- CBNRM and its local representatives need to provide promoters and others with more complete accounting information and financial records, also in local languages or arabic.

Annex G.

Use of Participatory Approaches in Program Implementation Strategies: Participation as a Means to Engender Sustainability

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March 1999

For USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
(EPIQ)

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1.0 Introduction

This report will focus upon an analysis of the implementation strategies of four USAID/Senegal-financed natural resource management (NRM) projects (Rodale, Winrock's OFPEP, KAED, and CBNRM) in order to determine if the projects used a participatory approach and if each project's approach will engender or discourage sustainable benefits in Senegal's rural sector.

The findings, conclusions, and recommendations found in this report are meant to complement the findings and analysis provided by other team members of the Impact Assessment team. As such the report assumes that the reader is already familiar with each project's background (LOP, objectives, financing, etc.) and leaves an analysis of technique details to other team members.

The bulk of this report will be devoted to an analysis of the on-going CBNRM project as per the Mission's request and since it is the only project currently in operation.

1.1 Methodology

the PRA/RRA team visited a total of 22 project sites (villages, zones, or CRs) where all four projects intervened during the course of the four-week assignment. The team visited two Rodale NRBAR sites; two Winrock NRBAR sites; seven KAED sites; and 11 CBNRM sites.

The PRA/RRA team developed two primary information gathering tools for its work. The first was a preference matrix in which village-level stakeholders listed all the NRM practices they have undertaken (with the project, with other projects, independently); to list the benefits and constraints of each technology; and to rank their preferences for adoption of these technologies. The objective of this checklist was to develop an informal appreciation of stakeholders' KAP regarding NRM and to begin analytical discussions with stakeholders concerning project interventions in the village and the impact these interventions have had on their lives. The PRA/RRA team divided themselves into three sub-teams while in the villages: one sub-team would build the matrix with men; one sub-team would build the matrix with women; and a third sub-team would walk around the village *terroir* with stakeholders and visit areas where NRM activities had been undertaken. The team would reassemble after each day's visit(s) to share, record, and analyze the day's findings and to determine new lines of inquiry for subsequent visits.

The author interviewed CBNRM project stakeholders in three *Communaute Rurales (CR)* to conduct interviews using a detailed checklist. Two other team members used the same interview checklist as well as a participation matrix developed by the author to interview CBNRM stakeholders

in three different *CR*. Their findings provided the basis for the author's conclusions concerning CBNRM's positive trend towards improved implementation in the later generation *CR*s. The author interviewed Project Management Unit (PMU) staff in Dakar on two occasions.

1.2 Philosophy

The team used the appreciative inquiry approach to gathering information when working with project stakeholders. The team met with the various groups of informants in order to "catch someone doing something right" by working with them to determine which aspects of the projects were successful and should be used by USAID when they design new projects. Once informants had exhausted discussions about the best aspects of a given project, the team entered into an analysis of how the project might improve its philosophy, approach, and implementation plan in the future.

1.3 Organization

This report is divided into nine sections starting with this introduction. The second section discusses why participation is essential to sustainable development and offers an operational definition of the participatory approach to rural development to which project's should aspire. The third through sixth sections analyze the four NRM projects under review. The seventh and eighth sections focus on conclusions and recommendations for the CBNRM project. The final section presents overall conclusions and recommendations concerning USAID NRM project impacts.

2.0 Participation as an Implementation Strategy

2.1 Rationale for Viewing Participation as a Means to Engender Sustainable Impacts

Participatory approaches are generally accepted as being the most effective means for projects to realize sustainable impacts in the NRM sector in the Sahel. However, it is appropriate here to review why this author argues that using a participatory approach in a project setting is the most effective means to ensure sustainable development. The following are the assumptions which underpin all subsequent analyses and recommendations.

Projects which engage in participatory processes end up being both entrepreneurial and empowering.

2.2 Participatory Projects are Entrepreneurial

Participatory projects are entrepreneurial because they effectively identify and meet their customers' needs in a timely manner. Projects using participatory approaches ensure that the project is, and is perceived by its beneficiaries, to be:

- relevant,
- feasible,
- appropriate, and
- in beneficiaries' real, and felt, short, medium, and long term interest.

Participatory approaches assure that project interventions will respond to rural producers⁵² needs as opposed to project and/or government agency needs. This point can not be over-emphasized since most "top-down" NRM projects tended in the past (and most still do) to impose activities at the village level that were either irrelevant, inappropriate, or even in direct contradiction to rural producers' interests.

2.3 Participatory Projects are Empowering

Projects using the participatory approach help rural producers to do some or all of the following:

- analyze their current situation to develop an awareness of the causes and consequences of the current environmental situation,

⁵² The term rural producer is used here to include both sedentary agro-pastoralists and nomadic herders.

- examine possible solutions to problems identified by the rural producers,
- develop strategies for implementing the best solutions to identified solutions which are technically appropriate, financially replicable, and socially acceptable,
- develop the skills and confidence necessary to manage a wide variety of activities designed to resolve identified problems,
- organize themselves when necessary in order to represent rural producers' interests and mobilize resources when interacting with other actors (government, projects, financial institutions, other rural producer groups),
- implement activities designed by rural producers with technical assistance from outside agencies,
- replicate the development cycle and continue the development process after the project's end.

Participatory projects promote empowerment in the NRM domain by creating the enabling conditions which will lead to the followin:

- rural producer-initiated NRM activities which will generate short- to medium-term economic benefits first and foremost though most activities will have long-term positive NRM consequences about which rural producers are aware and which they appreciate.
- a proliferation of small-scale rural producer-initiated NRM activities which are replicable on a broad scale with minimal recourse to outside technical assistance and financial resources.
- rural producers adopt NRM practices which help increase production and have important conservation benefits, are risk-spreading, and low-cost, and are replicable given their management and labor constraints,
- functioning, decentralized, decision-making bodies which are capable of aggregating and articulating rural producers' interests and organizing activities to resolve identified NRM problems.
- the ability, confidence, and legal right to seek funding support from financial institutions.
- increased rural producer demand for appropriate NRM information and technical assistance provided by projects, government agents, and (eventually) private sector service providers.
- rural producer-led experimentation with NRM activities which lead to innovative NRM techniques which are easily transferable.
- increased contact between rural producers to discuss NRM issues with peer-led technical transfer (spread effect) gaining in prominence.

2.4 An Operational Definition of Participatory NRM Projects

The table below presents an operational definition of participation based upon the major tasks performed during a typical project cycle of an model participatory project that is both optimally entrepreneurial and optimally empowering. The ODP table is adapted from responsibility matrices that are used to determine where decision-making power for, influence over, and appreciation of, specific tasks is found within formal organizations (private and public sector). Such responsibility matrices provide interested parties with a quick snap shot perspective of where decision-making power is found.

This operational definition of participation (ODP) table is adapted from similar tables used to help clarify major stakeholders' roles and responsibilities in participatory NRM projects in Niger. The first ODP table was developed at a regional conference by stakeholders from the village-level through national level or a rural producer-centered NRM project in Niger for which the author worked. A second iteration of the ODP table was developed by a team of which the author was a member to summarize the lessons learned during an assignment in which the author had the opportunity to visit eight participatory NRM projects in Niger.

The ODP creates a vision of rural producers who are involved in, and who eventually become responsible for, all major tasks required to achieve sustainable NRM at a village (and a *terroir*) level. This vision is based upon the author's operational experience in Niger, but more importantly, upon the experiences of a cadre of similar projects throughout the Sahel in which rural producers assumed full responsibility for long-term land use planning and for all the activities required to implement the plans.

The third iteration of the ODP table has been adapted to meet two specific needs for this analysis. First, the table was adapted to reflect the unique challenge faced by CBNRM staff as they attempt to scale-up the impacts of the traditional village-based participatory *Gestion de Terroir* NRM project by focusing its intervention at the *Communaute Rurale* level rather than the village level. As such, the table includes two planning stages to better reflect how projects such as CBNRM can promote sustainable development through participatory NRM activities (see discussion in Section 6 for more details). Second, the table was adjusted slightly from project to project to reflect the various projects' major tasks.

The author used CBNRM's major tasks when developing the model ODP to which the other projects will be compared since CBNRM is the only project still being implemented and is the major focus of this report.

The project's major actors are listed horizontally. The reader will note that the fourth column from the left "NRMCM" is also specific to the CBNRM project and denotes the *Conseil Rural* (CR) level Natural Resource Management Committees which were brought into existence at the project's

behest. The author included this stakeholder group in the "model" table, even though an equivalent can not be found in other project settings, because it is an innovative institution which merits being held up for consideration as a model for other projects.

There are five levels (or gradations thereof) to characterize specific stakeholder's involvement in (or responsibility for) a specific task in the project cycle. The terms used to denote the differing levels of involvement have the same meaning as used in everyday language with the exception of "Appreciate". "Appreciate" indicates that the stakeholder has the right to be kept aware of how a task is proceeding but can not influence nor control its outcome. If two stakeholders share "Control" then they are required to collaborate before decision can be acted upon. In case of conflict, the stakeholder who is higher in the hierarchy will prevail though at a high cost to that stakeholder.

The following example drawn from the table illustrates how the reader can interpret the ODP tables.

"Training":

- the promoter has "Control" in that, as a group, promoters would indicate the subject matter to be covered; timing; and other logistical details which would impact the training program's relevance and accessibility. Under this ideal approach, promoters would (eventually) assume responsibility for the entire contracting process (develop Scopes of Work; let bids; select service providers; draw up contracts; monitor and evaluate training quality; payment for services) so that such activities could continue after the project's end. Experience throughout the Sahel proves that promoters can master all the above tasks.
- the rural producers, NRMC, GOS, and Project Staff have "Influence" because each group would provide input concerning examples of other training programs which have been successful in other contexts, effective training service providers, and would mentor promoters as they assume increasingly greater responsibility for the process.

Decision-making power must rest as much as possible with promoters since they are the primary clients to whom the project must respond if it is to effect change in NRM practices on a sustainable basis beyond the project's life⁵³.

The Model ODP shows a preponderance of "Control" resting with the rural promoter and "Influence" and "Appreciation" being reserved for government officials and project personnel. The body of evidence from participatory rural development projects worldwide has proven that rural producers

⁵³ This point will be further expanded upon when discussing the CBNRM project given that project's innovative approach to targeting CR-level organizations to act as intermediaries with the rural population they represent.

can fulfill the role described for them in the ODP and that the resulting planning and activities are more multi-layered, appropriate, and innovative than could be developed by project staff.

A review of the table shows that model participatory project personnel (their agents and government technical services) are not passive. The preponderance of "Influence" and the occasional "Control" ranking illustrate that it is incumbent upon project staff and other technical assistance agents to fulfill their role as change agents in order to encourage rural producers to experiment with new approaches and technologies.

On a positive note, it is incumbent upon technical staff to determine where other projects and programs have developed promising activities which deserve to be replicated within the project zone. Thus, projects such as the Jig-Jam initiative described below should be analyzed and promoted by project staff to stakeholders as an example of what is possible in the rural development sector.

On a more preventive note, it is incumbent upon technical staff to prevent rural producers from undertaking activities which the technical staff know to be counter-productive. Thus, for example technical staff can not, in the name of using a participatory approach, allow rural producers to plant a specific tree species which are inappropriate for (or will yield results counter to) the objective for which it is planted. Once again, participatory projects seek simply to redress the imbalance which occurred in Top-Down projects in which rural producers had no say whatsoever in project planning and implementation -- they do not seek to remove nullify the role of experts.

Thus, to continue with the training example above, project staff can easily anticipate and plan for many of the training topics which promoters (and the NRMCC) will demand during the course of the project. However, the project should not propose a ready-made list of training topics with attendant schedule and service providers to project beneficiaries before the need for such services is felt, and demanded by, beneficiaries.

If necessary, and to avoid becoming passive, project personnel can initiate one or two training programs which can "jump start" rural producers' demand for training. Project staff must always stress that project-initiated training programs have been initiated in response to rural producer expressed needs (usually captured in project-level planning documents such as Land-Use Management Plans - LUMP). However, to provide more than one or two project-initiated training sessions would be to take ownership of the training programs away from the beneficiaries and would reduce participants to the role of passive recipients of a project's largesse's -- which would reduce the program's ultimate effectiveness.

Each stakeholder group has experience, expertise, and a perspective which it must bring to the project implementation process. Rural producers are local experts who have extensive knowledge of the local milieu and mores. Change agents (project representatives, government officials) have access to information and innovations on a region-wide basis. The project's (and other change

agents) responsibility is to bring new information and innovations to the attention of rural producers and present it in such a way that rural producers can use their newly improved analytical skills to determine the appropriateness of such information and innovations for their needs.

All following discussions concerning the participatory nature and the effectiveness of the projects under review in this report will refer to the ODP table and the characteristics of an ideal participatory projects. The author will:

- compare the model ODP (of a fully participatory NRM project) to the approach used by the four different projects;
- discuss the impacts that the differences between the projects' approaches and the model ODP have had in terms of project effectiveness, and
- draw lessons and make recommendations concerning project impacts and sustainability for USAID.

In each instance, the author will summarize findings about the participatory nature of each project in an ODP table of the project since all projects claimed to be participatory (or include participatory elements) in their approach. However, the four projects represent three distinct approaches and philosophy which must be accounted for in their analysis.

Operational Definition of Participation - The Model

C-	Control (Pouvoir de Decision)
I -	Influence (Appui)
A-	Appreciation
N	- None (neant)
NA	- Not applicable

Major Tasks in Project Cycle	Rural Promoter	Other Rural Producers	NR MC	Government	Project
1. Planning -Project Level					
Problem Identification	I / C	I/C	C	I	I/A
Analysis of solutions	I / C	I/C	C	I	I
Long-term planning/LUMP	I / C	I/C	C	I	I/A
Conception of Sub-projects	I / C	I/C	I/C	I	I
Development of "Cahiers de Charge"	I / C	I/C	I/C	I/C	I
2. Planning - Activity Level					
Problem Identification	C	I	I	I	I/A
Examining Alternative Courses of Action	C	I	I	I	I
Preparation/Submission of Proposals	C	N	A	A	A
Selecting proposals	I	A	C	I	I/A
3. Implementation					
Letting Contracts	C	A	I	I	A
Labor	C	I	A	A	A
Technical Assistance	I	A	C	C	I/A
Managing Activities (Sub-Project)	C	I	I	I	A
Monitoring Activities	C	C	C	C	I
4. Other					
Training	C	I	I	I	I
Environmental Monitoring	C	A	C	C	I/C

Evaluation of overall project activities	C	I	C	C	C
Relations with exterior (outside project - financial etc.)	C	C	C/I	I	C

The first two projects; Rodale and Winrock could be characterized as action-research activities in which project staff tried to introduce new technologies generated by ISRA and adapted by the project into the village milieu. The primary line of inquiry concerning these projects will be to determine whether the projects were entrepreneurial ---i.e. did the "packages" being promoted respond to villagers' felt needs in general and were attempts made to incorporate specific villager needs into project activities?

The third project's, KAED, approach and level of intervention reflect standard *terroir* based interventions which simplifies an analysis of the project using the ODP instrument. The final project CBNRM, must be analyzed in terms of whether it is possible, and whether it has "scaled up" the benefits of the participatory NRM approach to the CR level. Projects such as CBNRM will have to use a representative, as opposed to a direct, approach to introducing sustainable NRM practices to rural producers and the primary line of inquiry in this report will be to ascertain if this approach is feasible in general and whether it is being achieved in the context of this project.

In the case of the CBNRM project, the author will use several ODP tables to summarize his findings concerning the project's approach as experienced by rural producers (the author will use the terms "promoter" and "villager" henceforth); NRM members; CERP team members. The ODP table summarizing the project approach from the PMU perspective was filled out by representatives of the PMU staff.

2.5 An Example of a Successful Community-Based Project

Before continuing, the author would like to present an example of a successful community-based NRM activity which reflects the ODP table and whose benefits will be sustainable beyond the life of the party.

Jig-Jam is a local association dedicated to rural development in the Fissel Rural Community (CR) in the Mbour region. The association has been in existence since 1974 and has funding support from Oxfam for a variety of activities it has undertaken.

Jig-Jam completed a reforestation project in 1994 which was not successful. Jig-Jam staff conducted a needs analysis with local rural producers. Their findings included the following:

- there was a general awareness of the causes and consequences of environmental degradation,
- rural producers wanted to do something to improve soil fertility,
- traditional reforestation approaches were not appreciated by villagers, and
- protection of natural regeneration, especially kadds, seemed feasible.

Jig-Jam, in collaboration with village associations, helped organize a village-level protection of natural regeneration scheme. Jig-Jam helped create an auxiliary force of "forest guards" to whom the Forest Service has ceded the right to levy fines for illegal cutting of kadds. There are now "auxiliaries" in 31 villages who are paid 2,500 CFA monthly. The size and importance of fines increases from 3,000 CFA to 30,000 CFA with auxiliaries remanding several people to the Forest Service for jail sentences in Mbour for three months. In addition, Jig-Jam used its rural radio system to broadcast information about how kadds were to be protected by the villages and why the local associations felt the need to undertake this operation.

Informants indicate that their efforts have not only led to a strong regeneration of kadds but that the CR of Fissel has more rain because of the kadds. Whereas the first claim was verified and the second one could not be, it is important to note that local people were now linking the presence of trees in their area with positive environmental impacts which is a refreshing change from the usual onerous task of having to interview rural producers about the negative impacts on their lives brought on by the absence of trees.

Results from an annual investment of \$1,860⁵⁴ over a four year period include:

- a visible increase of kadds at the CR level in Fissel with attendant increased agricultural productivity in 31 villages,
- improved links between rural producers and the Forestry Service with the latter becoming viewed as a partner in development,
- decentralized governance in action with benefits accruing to rural producers, and
- a NRM success which is entirely due to local-level efforts.

The activity has many of the characteristics of a participatory NRM intervention as planned by rural producers for rural producers. As such it is:

- low-cost,
- low-risk (no opportunity costs),
- promotes food security,
- based on rural producers' priorities,
- technically and operationally feasible given rural producers' constraints.

⁵⁴ Which is less than the investment required for a one hectare mono-culture woodlot.

Every activity has unintended consequences. The kadd protection activity in Fissel has negatively impacted women who have had a harder time collecting firewood because fewer branches are cut. However, because of the improved relations with the Forestry Service, women believe that the Forest Service should help them by organizing firewood collection trips.

The women's idea demonstrates the medium and long-term benefits which can accrue from a participatory activity. Whereas most rural producers prefer to avoid contact with the Forestry Service in order to avoid being fined, women in the Fissel area are contemplating requesting customer service from the Forest Service to help mitigate an on-going problem. The women are beginning to evolve from being policy endurers to policy influencers which is a crucial first step towards improved grass-roots democracy and governance.

One of the primary responsibilities of project and donor organization personnel is to find and analyze examples of success such as Jig-Jam to determine if they are replicable. If such projects are deemed worthy of emulation, project personnel and donor staff should promote replicating such projects through visits to the project area.

3.0 Rodale NRBAR Activities

Operational Definition of Participation - Rodale

C-	Control (Pouvoir de Decision)
I -	Influence/Appui
A-	Appreciation
N	- None (neant)
NA	- Not applicable

Major Tasks in Project Cycle	Rural Promoter	Other Rural Producers	Facilitator	Government (ISRA)	Project
1. Planning - Project Level					
Problem Identification	N	N	I	C	C
Analysis of solutions	N	N	I	C	C
Long-term planning/LUMP	N	N	I	C	C
Selection of Activities	N	N	N	C	C
Development of "Cahiers de Charge"	NA	NA	NA	NA	NA
Preparation/Submission of Proposals	N A	NA	NA	NA	NA
2. Planning - Activity Level					
Problem Identification	A	A	I	C	C
Examining Alternative Courses of Action	A	A	I	C	C
Preparation/Submission of Proposals	N A	NA	NA	NA	NA
Selecting proposals	N A	NA	NA	NA	NA
3. Implementation					
Letting Contracts	N A	NA	NA	NA	NA
Labor	I/C	I/C	I/C	A	I
Technical Assistance	A	A	I/C	C	C

Managing Activities (Sub-Project)	A/I	A/I	C	A	I/C
Monitoring Activities	A	A	I/C	C	C
4. Other					
Training	I	I	I	NA	C
Environmental Monitoring	N	NA	NA	NA	NA
	A				
Evaluation of overall project activities	N	N	N	N	C
Relations with exterior (outside project - financial etc.)	N	N			C

3.1 Aspects of the Project Approach Which Promoted Participation and Sustainability:

N.B. The team focused on a minor portion of Rodale's activities linked to NRBAR testing during the course of this assignment. The team did not visit nor analyze Rodale's more basic program which focus on women's activities in general and women's gardening activities and organic gardening in particular. The narrow testing under NRBAR which is the focus of the team's analysis is not representative of Rodale's wider program and the comments found below should not be construed as such.

The following are the major points concerning the impact of Rodale's approach (under the auspices of NRBAR) had on the degree of participation enjoyed by the rural producers and the project's sustainability.

- the project conducted village-level varietal tests which project facilitators used to analyze and promote new ideas,
- the project recruited facilitators from the participant villages who generally remain in the village after the project's end and who have continued to work as a change agent in the village setting.

3.2 Aspects of the Project Approach Which Limited Participation & Will Mitigate Sustainability

- promotion of innovations that are not financially feasible for villagers.
- promotion of innovations that are not logistically sustainable for villagers.
- promotion of project interests to the virtual exclusion of villager interests.

3.3 Conclusions

- The project was minimally entrepreneurial since the technological package was developed at the project level and extended to villagers without true input from villagers at any point in the project planning process.
- The project was minimally empowering to villagers as a whole though, outside of providing training in the technological package, the project did not concern itself with most aspects of involving villagers in most phases of the project cycle.
- The most important positive impact of the project on the village visited by the team was the support provided by the project to the village facilitator. An unintended consequence of the project's support of the facilitator is that he was elected to the CR which can now benefit from having a project-trained member.
- The team noticed little spread effect of project-introduced innovations in the villages visited.
- Project activities were listed as the lowest priority NRM activity by villagers in the village where the team requested that informants create a Preference Matrix for the team (see Matrix below for example).
- The villagers requested assistance from the project to assist with on-going NRM activities. According to villagers, the project declined villagers request for collaborative assistance because the activities lay outside the project's prescribed activities.
- The project team used the PRA to ostensibly determine villager needs. This author questions the sincerity of the team's commitment to collaborating with villagers to analyze villager needs and develop activities to meet those needs since:
 - % the PRA's finding coincided with the project's pre-determined activities,
 - % villagers did not mention the PRA during interviews with the team,
 - % there was little spread effect of project-introduced innovations because they were not very appropriate, and
 - % project innovations were ranked as least important by villagers during the team's visit.

3.4 Discussion

The Rodale NRBAR approach should not be evaluated in terms of a fully participatory project because its objectives are different. However, it is legitimate to analyze the project's impact in terms of the degree to which it was entrepreneurial -- did the project seek to identify and then meet villager needs?

The Project Level planning process took place before the arriving in the village. The project did not intend to develop village-level capacity. The project was designed to field-test technological packages including the introduction of cement compost pits and improved seed varieties. Any discussion of empowerment is therefore only marginally pertinent to evaluating the project (even

though the project did use a PRA process to create a semblance of participation as discussed below).

A discussion of the project's entrepreneurial nature is appropriate. The technologies being promoted by the project do not appear to be financially and logistically feasible (according to informants) and therefore are not replicable. The efforts to promote compost pits were not successful (there was no spread effect) because of the pits' prohibitive costs (30,000 CFA according to informants). The promotion of improved seed varieties is not logistically replicable since villagers do not have ready access to these varieties.

Thus, the Rodale NRBAR project was only tangentially relevant to the villagers interviewed by the team because the packages being promoted were inappropriate. If the project had actually included villager input at some point in the "analysis of solutions" component of Project Planning, it would have developed less costly compost pits (surface composting; use of *Guiera senegalensis*, etc.)

Preferential Matrices as developed by men and women informants (Village of Ndoff)

Men - Technique (Prioritized)	Benefits (Prioritized left to right)				
Broadcasting	Reduces erosion	Increases productivity (30% estimate)	Improves the soil	Reduces wind erosion	
Household manure "Parcage" (herds on fields)	Reduces erosion	Increases productivity (30% estimate)	Improves the soil	Reduces wind erosion	Energy source
Protection of Natural Regeneration - Pastoral Zone ("mise en	Feed for animals	Housing material	Material for composting		

defens")*

*

Compost

*

Reduces
erosion

Increases
productivi
ty (30%
estimate -
but for
three
years)

Improves
soil

Reduces
wind
erosion

Improved
Seeds*

Increased
productivi
ty

Short
cycle

Wind
Break
(Prosopis
)**

Stops salt
intrusion

Reduces
wind
erosion

Creates
micro-
climate

Wood
source

Prosopis
and
Mango
trees
"Nursery"

**

More
wood for
live
fencing

More
material
for dead
fencing

Women - Technique (Prioritized Vertically)	Benefits (Left to right prioritized)			
Rice Production	Food			
Salt Collection	Revenue producing			
Wind Breaks	Stop wind	Branches for Dead Fencing (Proso)	Fodder (Proso)	
Fruit Trees*	Food	Revenue for Communal Chest		
Market Gardening*	Food	Revenue for Communal Chest	Demonstratio n Effect	
Improved Cookstove	Reduce Wood Consumption	Fewer fires	Fewer Children Burned	Fast cooking
Live Fencing	Reduce cost of fencing	Pharmacopie		
Village Wood Lot - eucalyptus	Construction wood (hilaires, mortars)	Pharamcopie	\$ caisse	Brise Vent Bois de Chauffe

* Introduced by Rodale NRBAR.

** Introduced by PRECOBA.

The final point above indicates a danger that was anticipated by practitioners once there was wide-spread use and adoption of participatory methodologies. Bara Gueye⁵⁵ and other pioneers in the field

⁵⁵ *Emergence et developpement de la Methode Active de Recherche et de Planification Participatives aux Sahel: Acquis Contraintes et Nouveaux Defis* (January 1999).

of participatory methodologies, have warned that, in effect, "a PRA participation does not make"⁵⁶.

Practitioners point out that the benefits accruing from the participatory approach are not due to the rote application of a series of tools but are based upon the sincere acceptance of the value of participatory tools by all parties involved. In this instance, the PRA may have been used by project staff and ISRA researchers as a justification for a pre-determined course of action rather than the sincere desire to engage in participatory research with project stakeholders.

⁵⁶ Thus continues the tendency of development professionals to use a part of a process to represent the whole. Examples from other fields include the belief that building schools or hospitals will result in a functioning educational or health care system much like the holding of an election is *a priori* proof of democracy.

4.0 Winrock NRBAR Activities

Operational Definition of Participation - Winrock - NRBAR

C-	Control (Pouvoir de Decision)
I -	Influence/Appui
A-	Appreciation
N	- None (neant)
NA	- Not applicable

Major Tasks in Project Cycle	Rural Promoter	Other Rural Producers	Facilitator	Government (ISRA)	Project
1. Planning - Project Level					
Problem Identification	I	N	I	C	C
Analysis of solutions	I	A	I	C	C
Long-term planning/LUMP	N	N	I	C	C
Selection of Activities	N	N	N	C	C
Development of "Cahiers de Charge"	N A	NA	NA	NA	NA
2. Planning - Activity Level					
Problem Identification	A	A	I	C	C
Examining Alternative Courses of Action	A	A	I	C	C
Preparation/Submission of Proposals	N A	NA	NA	NA	NA
Selecting proposals	NA	NA	NA	NA	NA
3. Implementation					
Letting Contracts	NA	NA	NA	NA	NA
Labor	I/C	I/C	I/C	A	I
Technical Assistance	A	A	I/C	C	C
Managing Activities (Sub-Project)	A/I	A/I	C	A	I/C
Monitoring Activities	A	A	I/C	C	C
4. Other					
Training	I	I	I	NA	C
Environmental Monitoring	NA	NA	NA	NA	NA

Evaluation of overall project activities	N	N	N	N	C
Relations with exterior (outside project - financial etc.)	N	N			C

N.B. As with the Rodale project above, the team was charged with analyzing a very small component of Winrock's activities undertaken in collaboration with NRBAR. The following comments are strictly limited to NRBAR-related activities.

4.1 Aspects of the Project Approach Which Promoted Participation and Sustainability:

The project:

- sought to link ISRA researchers to villagers by field testing ISRA innovations,
- used the PRA as a site selection tool to determine if villages met certain pre-conditions before working with a village. One effective selection criteria was the presence of existing village organizational structures and/or project activities. This criteria was particularly important given the project's limited resources.
- followed up on the PRA with socio-economic studies to determine if the villagers could afford the project's technological package.
- worked to introduce an array of activities for adoption (compost; improved seed; combining live fencing with a cash crop; natural regeneration of kadd) and used a collaborative approach to promote the adoption of improved seed varieties.

4.2 Aspects of the Project Approach Which Limited Participation & Will Mitigate Sustainability

- promotion of innovations that are not financially feasible for villagers.
- promotion of innovations that are not logistically sustainable for villagers.
- the time allotted to implement this component of OFPEP was too short to create a functioning feedback loop from villagers to ISRA researchers.

4.3 Conclusions:

The project sought to mitigate traditional extension projects' weaknesses through careful selection of technological innovations and careful selection of villages in which the project would participate. Long-term impacts, at the sites visited, may be negligible because the project's life was too short to

carry out an effective iterative process whereby researcher innovations are adjusted in response to villager feedback. However, the team assumes that, in those villages in which Winrock has longer term activities through its OFPEP programming will benefit from lessons learned during NRBAR activities.

5.0 KAED

Operational Definition of Participation - KAED

C-	Controle/Pouvoir de Decision
I -	Influence/Appui
A-	Appreciation
N	- None
NA	- Not applicable

Major Tasks in the Project Cycle	ABE /GIE *	Ani mate ur/ Facil itator	CER P/G OS	Proj ect
1. Planning - Project Level				
Problem Identification (1)	C	I	N	I
Analysis of Solutions (1)	I / C	I	N	I/ C
Long-term planning	I / C	I	N	I
Conception of A.G.R.	A	I	N	C
Development of "Cahiers de Charge" (RFPs)	N A	N A	N	N A
2. Planning - Activity Level				
Problem Identification	I \ C	I\C	N	C \I
Examining Alternate Courses of Action (3)	A	I	N	I
Preparation/Submission of Proposals (ABE Business Plans)* (2)	C	I	N	I
Selection of Proposals (2)	C	I	N	I
3. Implementation				
Letting Contracts (4)	A/ N	I/C	N	A
Labor	C	I	N	A
Technical Assistance (5)	I	I	N	A

Managing A.G.R.s	C	I	N	A
Monitoring Activities	C	I/C	N	I
4. Other				
Training (5)	I	I	C	I
Environmental Monitoring	?	?	N	I/ C
Evaluation of overall project activities	?	I	N	C
Relations with exterior (outside project - financial etc.)	N	N	N	C

% KAED promoted Groupement d'Interet Economiques which the project referred to as Agriculturally-Based Enterprises (ABEs).

5.1 Aspects of the Project Approach Which Promoted Participation and Sustainability:

The following are the major points as drawn from the table above concerning the impact the project's approach had on the degree of participation enjoyed by the villagers. Where appropriate, the points made below are linked to specific project tasks through parenthetical numbering (1).

- USE OF PRAs AS A DIAGNOSTIC TOOL(1) - The KAED staff used PRA tools in each of the sites to determine, with villagers, the primary economic activity to be undertaken in the village (*MARP Diagnostique*).
- USE OF GIE AS ORGANIZING PRINCIPLE - the project's approach was in accordance with GOS policy which promotes GIEs as the means by which rural producers can obtain support and funding from formal institutions.
- CREATION OF THE DEMONSTRATION FIELDS - primarily as a source of capital to provide the GIE with a small degree of financial autonomy.
- GIE TRAINING - Once a primary economic activity was chosen the project field agents led the GIE through an iterative process of management and technical training, site visits, and more training in order to provide the GIEs with the skills and experience they needed to manage their chosen income-generating activity. Informants demonstrated a high degree of knowledge of financial management practices.
- FUNCTIONAL NUMERACY & LITERACY CLASSES - Not only do rural producers acquire management and accounting skills but they reviewed various legislative texts such as the Forestry Code.
- LINKING GIEs WITH FINANCIAL INSTITUTIONS(2) - successful GIEs have established strong reputations with the CNCA and have continued their activities after the

project's end. This is an indicator that long-term benefits will accrue to the GIEs which were functioning long enough to develop a successful financial track record with the bank.

5.2 Aspects of the Project Approach Which Limited Participation & Will Mitigate Sustainability

- **LIMITING THE SCOPE OF RURAL PRODUCER DECISION-MAKING POWER(3)** -the project had a pre-determined list of acceptable income-generating activities from which project participants were required to choose. The participation process was truncated during the planning phase which reduced participants' role in learning how to compare the relative merits of different schemes. In addition, because the list of acceptable activities was pre-determined, the relevance of the IGA activities undertaken under KAED's auspices was reduced. For example, many informants indicated that animal fattening (*embouche*) did not provide a high return on investment compared to other activities and would not have been their first choice for an IGA (though the team could not determine if villagers held this opinion from the outset or if they developed this perspective after not realizing anticipated profits from the activity)
- **EXCLUDING GIE MEMBERS FROM THE CONTRACTING AND PROCUREMENT PROCESS (4)** - KAED project staff took full responsibility for procurement of capital equipment (millet grinders etc.). The project staff missed the opportunity to provide GIE members with practical experience managing a transparent procurement process (letting and reviewing bids) and for establishing links between GIEs and formal sector vendors in Kaolack and beyond. Informants could not describe how they would procure replacement equipment even though they were saving for such an eventuality.
- **EXCLUDING GOS OFFICIALS FROM THE PROJECT PROCESS(5)** - KAED staff indicated that they decided to limit GOS involvement to providing training to staff and beneficiaries. The project staff provided the GIEs with all necessary technical assistance. Project staff admitted to having tenuous relations with local level government officials because of their decision to limit the government officials' role in project implementation.

5.3 Conclusions

- The project's participatory approach was very strong when it included villagers in the process.
- The project's operational approach appears to have focused too much on operational efficiency during the life of project (LOP) period and not enough about GIE operational efficiency once the project ended. The project's decision to short-circuit the participatory process during the implementation phase and the decision to exclude

GOS officials from project operations will have negative long-term impacts on any benefits accruing the participants.⁵⁷

- The project was only fully operational for three years which cut short many nascent group-building activities by GIEs which would have led to a greater impact overall.

⁵⁷ The author critiques KAED's decision to exclude local-level GOS officials from project operations while fully understanding the rationale and temptation to do so.

6.0 CBNRM

6.1 Introduction

This section of the report will be more detailed in its analysis and discussions because the team has been charged with combining an impact analysis of the Community Based Natural Resource Management (CBNRM) activity with an mid-term evaluation. This section will first discuss the challenges facing CBNRM as it attempts to "scale-up" a participatory project to the CR level and whether this can be done given the constraints under which the project works. The report will then analyze the project's degree of participation from four perspectives: promoter (as interpreted by the author); Natural Resource Management Committee (NRMC) member; local-level government official (CERP) level; and PMU level. As stated above, the first three ODP tables were completed by the author with input from NRMC and CERP stakeholders where appropriate. The PMU table was completed by project staff.

The second section of the CBNRM analysis presents the author's overall conclusions; conclusions concerning each level of project stakeholders; and the results of the project's approach at the village level. The recommendations will follow and will be based upon the same format.

6.1.1 Analyzing the "Scaling Up" of Participation

All participatory NRM projects in the Sahel to date have focused on the village or the *terroir* level. As such, projects and programs have been able to link directly with their customer -- the rural producer. An ODP of such projects would not necessarily differentiate between the two levels of planning as the model ODP table does because the stakeholders would have the same role to play at both levels.

The village-based NRM approach has proven to be extremely effective but highly costly in terms of time, specialized labor, and resources. The approach, though extremely promising, does not seem to be replicable on a national let alone a Sahel-wide scale. Most participatory NRM projects impact between 20 to 50 villages. Most such projects do enjoy a healthy spread effect yet they still can not be expected, as currently designed, to have a great enough impact to stop or reverse environmental degradation.

USAID responded to the short-comings of the village-based participatory NRM projects by designing the CBNRM project to focus at the CR level. The project seeks to create the enabling conditions throughout the CR necessary to promote sustainable NRM by introducing participatory processes and promoting human resource development at that level. This process of trying to spread the benefits of participation across a larger geographic area and a larger population base through more extensive use of representatives and proxies is often referred to as

"scaling up." Thus, village-based participatory projects can be viewed as playing the role of pilot projects for the CBNRM project which is now responsible for scaling the participatory approach to NRM up to the CR and higher levels. The project designers assumed that by training and supporting CR-level stakeholders, the project could enjoy a multiplier effect as these individuals would replicate the project's participatory process at the grass-roots level.

A short-hand way to describe the difference in between the village-centered projects' and CBNRM's CR-centered approach is to refer to the former as a direct-link project and the latter as a representative-link project.

The direct-link project is characterized by direct and consistent contact between paid project personnel and grass-roots stakeholders. The grass-roots stakeholders can interact with the project as individuals (who interact with, and benefit from, the project on an individual basis) or as a group sort. Groups are generally based upon pre-existing organizations or upon village-based organizations.

The representative-link project (of which CBNRM is the only example to date) is characterized by direct contact between paid project personnel and intermediary representatives of grass-roots stakeholders. CBNRM, under the Sub-project approach requires that grass-roots stakeholders be represented by inter-village "federations" in order to facilitate communication at the project-beneficiary nexus. It is assumed, once again, that the federation leaders (promoters) will complete the communication link from PMU through to individual grass-roots stakeholder.

The key question to consider when analyzing whether CBNRM will have a sustainable impact on Senegal's NRM sector if a representative-link project will be entrepreneurial and empowering for a critical mass of stakeholders in the project's zone of intervention (CR). Will the project's resources, approach, and training create the conditions in which NRM, CERP, Sub-committee members, promoters, and grass-roots stakeholders will be willing and able to fulfill their roles and responsibilities as described in the model ODP.

The model ODP was adapted from the direct-link model to describe a situation in which a representative-link project could achieve sustainable results by being entrepreneurial and empowering. Under the adapted ODP model, grass-roots stakeholders do not need to "Control" or be intimately involved in the Project Level planning phase of the project cycle. Instead, the intermediary representatives are charged with conducting the analytical work during the Project Level Planning phase.

The intermediary representatives can only contribute to a sustainable development process if they:

- represent the entire spectrum of interest groups in a given area,
- aggregate and articulate the interests of the stakeholders who they have been assigned to represent, and
- communicate what they have learned back to their constituents.

The intermediary representatives (as in a representative democracy) speak for their constituents when the CR-level plans (PRA report; LUMP; Work Plans) are being generated. These plans provide the framework for all subsequent activities and must be referred to when all decisions are made at the CR and the grass-roots level. Even though grass-roots stakeholders are intimately involved in the Project-Level Planning Phase, their interests will have been accurately articulated by their representatives. In turn, the representatives are responsible for communicating the results and benefits of the Project-Level Planning Phase back to their grass-roots level constituents.

The Project-Level Planning Phase of the process as described above will be entrepreneurial and empowering for intermediate representatives which increases the chances that they will be willing and able to continue this, or similar participatory processes on a sustainable basis (i.e. after LOP). This phase will be entrepreneurial for grass-roots though not necessarily empowering since they were not personally involved in the process and therefore learned less about how to participate in similar exercises in the future. The disadvantage of having each grass-roots stakeholder less deeply involved in the Project-Level Planning Phase will be offset by having LUMPs which reflect grass-roots stakeholders' needs and which impact a larger number of grass-roots stakeholders -- successful "scaling up".

If the representative-link model is to be sustainable, the grass-roots stakeholder becomes the focus of the process and the locus of decision-making during the Planning - Activity Level as described in the model ODP. All activities implemented under the project's auspices will be designed and implemented by promoters in accordance with the project's framework planning documents and with assistance when necessary from the intermediary representatives or from CERP members (in the case of technical assistance). As such, promoters will become empowered during this phase because they will be called upon to identify specific problems and analyze solutions to be undertaken for a specific activity (be it at the individual, the village, or the federation level) by using the local-level LUMP and other planning documents as the framework in which to operate. It is this author's contention that the benefits of implementing grass-roots activities can not be sustained if grass-roots participants are not directly involved in the subsequent phases of implementation.

If all subsequent phases of project implementation must directly involve grass-roots stakeholders in order to realize sustainable benefits, then projects such as CBNRM which are designed to scale-up the benefits of the participatory approach to NRM must develop approaches which

decentralize decision-making power as move it as close to the grass-roots level as possible. Scaled-up participatory projects need to push the locus of decision-making concerning the financing of grass-roots level NRM activities to the CR level if possible ("Selecting Proposals" on the model ODP).

6.1.2 Challenges Facing CBNRM

Much of the following analysis can be interpreted as being critical of CBNRM's implementation approach and its tactics but it should not be. The author's, and the team's approach has been that of appreciative inquiry in which the team went into the field in order to find everything that is positive and sustainable about the project. When areas for improvement were identified, the team sought to develop strategies and approaches to reinforce the PMU's efforts which were feasible and which would complement those efforts.

The author is acutely aware of three major challenges facing CBNRM. First, CBNRM is attempting to bring the theory of decentralization and participatory governance to reality in a social and institutional environment where leaders are expected to act in an authoritarian manner. CBNRM is working to reverse authoritarian leadership styles within the GOS and the civil society which are based upon long-held traditions and reinforced by the colonial and post-colonial unitary form of government found in Senegal. The PMU, through training and modeling participatory management styles, must overcome beneficiary's expectation of how a project (and leaders in general) should act which colors beneficiaries' perceptions of their role and the PMU's role in the project.

Second, as mentioned above, CBNRM is focusing its activities at the CR level with CR-level beneficiaries (CERP, NRMC, and the local-level Animator) acting as the interface between the project and villagers. This approach is innovative and there are few precedents to which the PMU can refer as it plans its activities. In addition, the PMU interacts with a large number of CERP members as well as NRMC members which reduces the amount of time PMU staff members can spend with any one group. The PMU is required to use surrogates and proxies to implement many of its activities and is dependent upon the ability and willingness of these people to work in a participatory manner with rural producers. Experience has shown that the CR-level project representatives have not often met these expectations.

Third, NRM activities and human behavioral change activities (introducing participatory management styles in an authoritarian environment) take years (in the latter case, perhaps generations) to have a discernible impact. Evaluations provide a diachronic perspective of a multi-year process which tends to give short shrift to how a project has evolved and whether it is moving towards the Strategic Objectives laid out for it during its design phase. This author will try to minimize the snap shot nature of evaluations by acknowledging where the project has learned from its experience and is moving toward improving its planning and implementation.

The PMU's ability to learn and the impact this learning has had upon the project's effectiveness is no more evident than when contrasting the perception of villagers in the first and the second generation CRs. Whereas the preponderance of discussion focuses on first generation sites, the PRA/RRA team was struck, and encouraged, by how CBNRM's trend is towards significant improvement in their operations in second (and third) generation CRs.

The author applauds the PMU's efforts and admires the dedication and expertise the members brings to their jobs. The project team has spent long hours traveling thousands of kilometers to test the concept of decentralized land-use planning in the field. The impact upon human resources at the NRMC level have been impressive and will provide a model for future projects of its kind.

However, the author is concerned that if concrete impacts are not seen and felt at the rural producer level (as opposed to the CR level) the project will not have developed a constituency base which will call for a continuation of CBNRM's, or a similar activity's, services as the project nears its end. This concern is particularly acute given that the project has begun to build a model for sustainable rural development based upon the lessons learned in its early implementation phase.

Such a constituency is necessary if CBNRM, or a similar follow-on activity, is to be given the time and the latitude to realize the full benefit of its efforts which could be considerable. Rural producers' perception overall is that the project has yet to deliver sufficient services to the rural producer level to justify the time and expense associated with being associated with the project. The causes of this perception will be discussed below.

6.1.3 Environmental Factors

There are many factors in the current project environment which have affected or constrained the project's effective implementation which should be noted here. They are important to note because these are factors over which the project does not now have control and should be acknowledged when evaluating the project.

First, the manner in which the project was introduced to the first generation CRs by local-level officials created expectations which could never be met by this or any other project.

Second, the first PRA/LUMP consultants did a poor job managing local expectations that had been raised during the project's insertion into the first generation CRs. Once that opportunity was lost, the project was working in an environment that made the use of the participatory approach difficult.

Third, the participatory approach itself is long and requires greater time and financial investment by beneficiaries. People used to more top-down projects will become impatient with the participatory approach and wish to accelerate what is being done.

Fourth, participants expect that project representatives will act in an authoritarian manner when implementing the project. Even if project representatives are working in a collaborative mode with beneficiaries, the latter group may not perceive them as working in that manner. As such, all stakeholders in a participatory project must change their expectations and attitudes about working in a project setting.

Finally, the project is constrained by its need to collaborate with USAID/Senegal. USAID's reporting requirements and expectations often impinge on the project's ability to plan and implement its activities.

6.2 The Evolution from Micro-Realisation to Sub-Project

The author will focus almost exclusively on the current sub-project phase of village-level activities in first generation CRs. However, the evolution from the earlier small project ("Micro-realisation" - MR) phase to this one is worthy of note for the following reasons:

- the MR approach to village-level NRM activities resulted in more than 600 proposals
- the proposals were remarkable for their lack of diversity in comparison to activities generally designed by rural producers in participatory projects in the Sahel
- 142 micro-realizations were finally accepted by the PMU,
- MR activities were almost exclusively village woodlots (using Eucalyptus) and cement compost pits.

The PMU, in a laudable attempt to continuously improve the project's approach, introduced the Sub-project approach to planning and implementing village-level activities. The rationale for Sub-projects was to:

- create a single point of contact per sub-project to facilitate communication between CBNRM representatives and grass-roots stakeholders,
- impose a greater diversity of NRM activities through controlling the design of the Sub-projects' RFPs (*Cahier de charge*) which were illustrative,
- impact a greater number of rural producers,
- create "poles of development" within each zone which would generate a large enough impact which to cause voluntary adoption of improved NRM practices by other grass-roots stakeholders in the area,
- create an enabling environment in which women could more freely participate.

6.3 CBNRM's Approach from Promoters' Perspective

The following description of promoters' perspectives on the project's approach focuses primarily on first generation CRs since these are the only zones in which the sub-projects are operational. The PMU has shown itself willing and able to learn from its experience and to improve its approach. As such, the PRA/RRA team interviewed representatives at second generation CRs to determine if the situation described by first generation CRs will come to pass in later generation villages once they become operational. The tentative conclusion to that question is that the PMU has adjusted its operational approach sufficiently to avoid replicating the problems found below.

The author chose the term "project representative" when referring to promoter - CBNRM interaction. This term denotes anyone who works directly with grass-roots stakeholders under the auspices of the project and can include: PMU staff; CERP officials; NRMC members; intermediate representatives and the project animator. The author deliberately chose this term because 1) CBNRM is a representative-link project and 2) promoters often could not identify the title of the CBNRM representative with which she or he was interacting. The term project representative more inclusive than the intermediary representative introduced above (who is primarily charged with acting as a proxy for grass-roots stakeholders interests during the project planning phases of the participatory process).

First generation: The approach experienced by project beneficiaries at the grass-roots level for first generation sites, as described in this table, is almost diametrically opposed to the model for a participatory project. The strong majority of promoters and other grass-roots level stakeholders in first generation CRs interviewed by the team were:

- unaware that the CBNRM project used a participatory approach to NRM,
- unaware that a PRA had been conducted in their zone in their name,
- unaware that a LUMP and a *Plan d'Execution* had been drawn up and was the basis for the sub-projects,
- unaware of whence the ideas for, and rationale behind, the sub-projects,
- unaware of the components of each sub-project and how the cost and sequencing of each was arrived at,
- (promoters were generally) unaware that they were head of an inter-village federation and that they were to act as a single point of contact between the CR-level project representatives and the federation,
- unable to indicate the information found in the sub-project contracts and financial management records,
- unaware of the NRMC intermediary representative in their zone, and
- unaware of, or unable to identify, how the sub-project activities would meet their most pressing food security or NRM needs.

These findings are all the more remarkable because the promoters were to act as the interface between the project representatives and the other, less highly involved grass-roots stakeholders. Outside of the functional literacy classes, project representatives have engaged in almost no activities at the grass-roots level since the end of the PRAs to empower promoters/grass-roots stakeholders. Grass-roots stakeholders were forced into the role of passive participants who were not engaged in any of the planning processes and who were only engaged once implementation started. Their role in implementation is to follow project representatives' instructions.

Operational Definition of Participation - CBNRM Promoters' Perspective

C- Control/Pouvoir de Decision
I - Influence/Appui
A- Appreciation
N - None (neant)
NA - Not applicable

Major Tasks in Project Cycle	R u r a l P r o m o t e r	O t h e r R u r a l P r o d u c e r s	N R M C	G o v e r n m e n t - C E R P	P r o j e c t
1. Planning - Project Level					
Problem Identification	N	N	I	I	C
Analysis of solutions	N	N	I	I	C
Long-term planning/LUMP	N	N	I	I	C
Conception of Sub-projects	N	N	I/ C	I/ C	C
Development of "Cahiers de Charge"	N	N	I	I/ C	C
2. Planning - Activity Level					
Problem Identification	A	A	I	I/ C	C
Examining Alternative Courses of Action	N A	N A	N A	N A	N A

Preparation/Submission of Proposals	I	N	I	I	A
Selecting proposals	A	A	I/ C	I	C
3. Implementation					
Letting Contracts	A	A	C	I	I
Labor	I/ C	I	A	I/ C	A
Technical Assistance	A	A	I	C	C
Managing Activities (Sub-Project)	I	A	I	I/ C	I/ C
Monitoring Activities	I	A	I/ C	I/ C	I/ C
4. Other					
Training	I	A	I	I	C
Environmental Monitoring	A	A	A	C	I/ C
Evaluation of overall project activities	N	N	I	I	C
Relations with exterior (outside project - financial etc.)	N	N	I	I/ C	C

The promoters felt minimal ownership of the activities to be undertaken and could not link the activities to their own needs. The project's approach to promoting new technologies did not reflect how they would experiment with, and then, adopt new practices and technologies. When asked, promoters generally described reasonable alternate strategies and approaches which were more applicable to their context and environment.

The promoters had received almost no technical and no management training and would generally not have implemented the sub-projects in their current form if they had had a hand in planning and implementing the sub-project activities. When asked why they implemented the sub-projects in the prescribed manner, promoters stated that they were told by project representatives that they had to follow the project's directions or the project would pull out of the zone. One promoter was under the mistaken apprehension that the village would receive cash payments if he were to implement village-level activities as per project instructions and that he could therefore not plant a certain, more desirable, species of trees to complement a rock bund.

Promoters described how they were told by project representatives (usually CERP personnel) what they were to do, how much activities would cost, when activities should be undertaken, and where they should be undertaken *"the project came here and told us that they wanted to write a project"*.

The project called us together, there were seven of us. They told us what they wanted to do. We were told to sit under that tree over there and decide who had 1.5 hectares of land for the project. I said I had the land so they made me responsible.

Promoters reported that they did not understand the Sub-project contracts provided them despite the fact that efforts were made during signing ceremonies to read and translate contracts in local language. Promoters' indicated that, despite these efforts, they did not have the chance to study the contracts before signing. One promoter had been given the wrong sub-project contract by CERP personnel and the problem had not been corrected in more than three months.

Promoters described financial management procedures between the NRM level and themselves which were spotty at best. The author read receipts generated by NRM members which had insufficient information to be of use; promoter regularly reported that NRM members retained both copies of receipts or engaged in off-the-books quid pro quo arrangements which would not be reconstructed if disputes arose. Even the most sophisticated promoters who were based in arrondissement capitals and who had extensive experience leading formal organizations were not in possession of all required financial records. This trend flies in the face of the NRMs' overall clean record on accounting and transparency at the NRM level.

Most promoters in the first generation sites were representing fictional inter-village federations. Many, as in the quote cited above, indicated that project representatives told them who was to be in the federation. Promoters reported great difficulty in getting federation members from other villages to pay for their portion of the village investments and many federations had fallen apart before any work had been done. As one promoter stated *"the project is bringing us our 20 sheep for this village. I think they'll bring sheep for the other villages too"* - thereby displaying minimal knowledge about the Sub-project's activities and minimal concern about other federation members.

There were four promoters, however, who were current or a former NRM members who had received financial and management training from the project. Their knowledge of the project's approach and the mechanics of the Sub-projects was high. However, most of these same promoters did not feel ownership for the Sub-project's objectives since they had not been involved in, nor were they aware of, the Project-level planning phase of the project cycle.

There are two exceptions to the rule that CBNRM operators acted as passive participants and these two instances are worthy of note. In both instances, the sub-project objectives coincided with an already-existing need as identified by an existing local association. In each instance, the promoters represented loosely-knit associations which were looking for support to protect low-

lying agriculturally productive zones. In each case, sub-project objectives and local-level needs overlapped and the local-level association is motivated to perform the work described in the sub-project.

However, even in these cases, the Sub-projects are not participatory. First, in neither case were the "federation" of villages a reality. Certain federations were multi-village but even those did not represent all the villages in the federation as identified by CBNRM. Second, the project sometimes imposed the choice of tree species upon villagers despite their being able to lay out a cogent rationale for using indigenous species for a variety of purposes. Third, villagers had received no technical nor organizational training to support their activities. Fourth, in one site, villagers felt the need to "hide" their choice for planting a wind break because it did not coincide with the project's plans even though the rationale for the actual tree planting was superior to that found in the sub-project plans. Despite these problems, the evaluation team expects the results from these collaborations to be productive, and can provide examples from which the project will be able to draw lessons.

Since the promoters are not partners in the project's participatory process, they find it to be overly long. One promoter captured the general level of concern by saying:

I have signed papers for four years. I keep hoping to get something with the project but I haven't seen anything. People are starting to laugh at us.

Later Generation CRs

The team believes that the finding listed above will not obtain in the later generation CRs because the PMU has taken several steps to remedy the situation described above for later generation CRs. Since grass-roots level activities had not started at the time of the team's visits, the conclusions arrived at here will need to be verified by others once activities have been undertaken.

There are two primary reasons why the project appears to be better positioned to promote participatory NRM in later generation CRs than in first generation CRs. First, the Project-level Planning Phase was more effectively implemented and expectations were better managed in later generation CRs. The PRA teams were larger and the methodology (combining central villages and satellite villages and not merely using one PRA tool per village) led to the PRA having a greater impact on grass-roots level participants. As such the conclusions drawn in the LUMP and Sub-projects are more legitimate and can be confidently pointed to as being the articulation of grass-roots stakeholders' interests and analysis.

Second, the intermediary representative linking function was better fulfilled in later generation CRs. The project developed improved member selection criteria for the Sub-committees and the NRMCM to ensure better coverage of all interest groups. In addition, the project empowered the zone-level Sub-committees which have greater credibility as representatives of peoples' interests than did the original NRMCMs. Informants expressed a serious commitment to fulfilling their responsibilities as intermediary representatives of their interest groups and as a communication conduit back to their constituents.

There appears to be a strong overlap between federation (the Sub-project executing agent at the grass-roots level) and sub-committee members (and NRMCM members). As a result, promoters appear to be much better informed of project processes. For example, in a departure from first generation CRs, promoters in later generation CRs were aware of the specification of the financial contribution, and how it changed after it was clear credit would not be available. Perhaps most importantly, promoters recognized the link and logical progression from problems identified in the PRA and LUMP to building sub-projects around these priority problem themes.

The results in later generation CRs are very encouraging and indicate that CBNRM is moving towards finding a workable representative-link model for participatory NRM. The author stresses that CBNRM should be evaluated in terms of direction of such trends towards improved processes and whether the project is increasing its ability to create the conditions under which a representative-linked participatory project might be able to effectively promote sustainable NRM.

6.4 CBNRM's Approach from the NRMCMs Perspective

The team interviewed NRMCM members from first and second generation CRs. The NRMCMs in the second generation CR filled out the participation tables below. The table found below is a synopsis of the seven NRMCMs which were interviewed (tables for two second generation committees are included in the appendix).

The project animators are included in this analysis of NRMCM members since their role in first generation CRs appears to be little more than secretary and communication conduit between various project stakeholders. As such, the animators do not merit being addressed as a separate stakeholder group within the project.

The NRMCM members felt that they played an active role in problem analysis for the project. They felt less empowered during the project's planning and implementation phases. All members displayed an impressive grasp of the project's approach, philosophy, and implementation plan (*demarche*) which is significant given the project's complexity and ever-evolving policies.

Committee members had participated in the PRA training and field diagnoses and felt that the LUMPs reflect local needs and interests. They also indicated that the PRA process helped raise rural producers' awareness of environmental degradation and, north of The Gambia, the steps that should be taken to combat it.⁵⁸

NRMC members spoke the language of the participatory approach and understood its benefits. Committee members in first generation CRs expressed pride in being more highly trained than other local-level committee members (on *Conseil Rurals* for example). Comments, constructive and critical, concerning the project were couched in terms of how participatory the project was. NRMC members were applying their skills and their sense of empowerment in other fora and felt that they were creating a demand for more effective local-level governance.

⁵⁸ Villager concerns about the destruction of forests in the Pata region will be addressed in more detail below.

Operational Definition of Participation - CBNRM, NRMC Perspective

C-	Control (Pouvoir de Decision)
I -	Influence (Appui)
A-	Appreciation
N	- None (neant)
NA	- Not applicable

Major Tasks in Project Cycle	R u r a l P r o m o t e r	O t h e r R u r a l P r o d u c e r s	N R M C	G o v e r n m e n t - C E R P	P r o j e c t
1. Planning - Project Level					
Problem Identification	I\ C	I\ C	C \ I	I/ C	I/ C
Analysis of solutions (1)	I\ C	I\ C	I\ C	I/ C	I/ C
Long-term planning/LUMP	C	C	C \ I	I/ C	I/ C
Conception of Sub-projects (1)	I	A	I	I/ C	C /I
Development of "Cahiers de Charge" (1)	A	A	I	I	C
2. Planning - Activity Level					
Problem Identification	C	A	I\C	I	C

	\I				
Examining Alternative Courses of Action	N	N	N	N	N
Preparation/Submission of Proposals	A	A	A	A	A
Selecting proposals	C	N		I	I
			I		
	A	A	C	C	C
3. Implementation					
Letting Contracts	N	N	C	I	C
			/I		
Labor	C	A	A	A	A
Technical Assistance	A	A	I/	C	C
			C		
Managing Activities (Sub-Project)	C	A	I	I	I
Monitoring Activities	A	A	I/	I/	C
			C	C	/I
4. Other					
Training	A	A	I	I	C
Environmental Monitoring	N	N	N	N	N
	A	A	A	A	A
Evaluation of overall project activities	N	N	I	I	C
Relations with exterior (outside project - financial etc.)	N	N	C	I	C
					/I

There are several key decision-making points at which the committees indicated that they were excluded from the process and were not empowered to the degree they thought they should be. The most important point at which the NRMC members feel excluded from the decision-making process concerns the types of activities which are allowable under the project's auspices. The following quote summarizes the point made repeatedly by others:

*Once we submitted the LUMP, then we found out what USAID wanted to do.
We wanted to work in many different sectors but Dakar then
gave us a list of activities from which we could work.*

NRMC members feel that their input concerning the types of activities to be undertaken, specifically income-generating activities (IGA) was neither sought nor heeded in a timely manner. They felt that the project was not open to negotiating differing opinions and options and that once the PMU made a decision, it was final with no recourse available to them "they say that this is

a research project, research means discussion, we do not have discussions. There is no room for discussion. We are told what to do by Dakar."

In another example,

a NRMC member pointed out that "water" was the first priority need identified in the LUMP. The PMU determined that the project could not afford to finance water-related activities during the *micro-realisation* phase of implementation and such activities were not included in proposals to the project. During the subsequent Sub-project design phase, NRMC members excluded all water-related activities from the Sub-project RFPs because they felt that the activities would be rejected out of hand by the PMU.

NRMC members also expressed concern that the project has an overly strict and unrealistic definition of NRM. As one member said, *"this is a project for the environment but humans live in that environment. The project needs to include human needs in the system."*

NRMC members reported that, as a result of the project's long planning process, there are villages within their zones where they are no longer welcome due to villager disappointment with the project.

Despite the above discussions and in a pattern that is repeated at each hierarchical level in this project; NRMC members indicated that the rural producers were participating fully in the project. NRMC members pointed to regular communication campaigns they conducted through which they (through the SAV commission or zone representatives), the CERP, or the animator kept villagers informed. They indicated that they also function effectively as a communication conduit from villagers to project personnel.

NRMC (and Sub-committee) members in later generation CRs concurred with the above analysis except they differed on the last two paragraphs/points. First, grass-roots stakeholders have not rejected the project as yet. Second, NRMC members were aware that they were not an effective communication conduit. The size of the CR (both distance and the fact that there are 120-150 villages to reach) means that they can not possibly do the job with the means available. They only have access to the CERP vehicle for a day or two on an intermittent basis which is insufficient to meet their objectives. Informants indicated that there are numerous fringe villages that probably have never even heard of CBNRM. Informants also stated that coordination was difficult when there were multiple CRs in one arrondissement. For example, informants cited when campaigns, such the collection of financial contributions for the sub-projects, all three (and soon four) CRs in the Arrondissement need access to the vehicle at the same time, which is not possible.

6.5 CBNRM's Approach from CERPs' Perspective

The following table is a summary of interviews with three CERP teams; two in first generation CR and one in a second generation CR. The newer CERP team did not comment upon Section 2 - Implementation, since the project had not reached that stage yet.

The CERP members' perception of the project approach and their role therein is remarkably similar to the NRMCM members'. They felt that they had participated fully in the analytical phase of the project (up to and including generating the LUMP). However, CERP members felt that they were not fully involved in policy decisions. For example, when discussing the change from *micro-realizations* to Sub-projects one CERP member said -

*we understood that the PMU had already made its decision about
the Sub-project approach so we tried to give them ideas
about small things to change*

despite the fact that the PMU conducted a workshop with CERP members to discuss the change. CERP members stated that the PMU used consultants too readily and did not mobilize their expertise and experience. The CERP members also felt that their feedback was not being heeded by the PMU despite regular quarterly meetings which minimized their role in the project. They stated that too many decisions were taken at the PMU level and that local initiatives were not respected.

The informants concerns about the use of outside experts is typical of “middle management” personnel who feel the disparity between their job responsibilities and their latitude for decision-making. This disparity appears to be real and is a result of the project’s highly centralized decision-making processes. In addition, most of the comments about consultants referred derisively to their pay rate which indicates a certain interest in benefiting from some of the funds being allocated for consultant services.

**Operational Definition of Participation -
CERP's Perspective.**

C-Control (Pouvoir de Decision)

I-Influence (Appui)

A-Appreciation

N-None (neant)

NA-Not applicable

Major Tasks in Project Cycle	R u r al P r o m ot e r	O t h e r R u r al P r o d u c e r s	N R M C	G o v e r n- m e nt - C E R P	P r o j e c t
1. Planning - Project Level					
Problem Identification	I/ C	I/ C	C \\I	I/ C	I/ C
Analysis of solutions	I/ C	I/ C	C \\I	I/ C	I/ C
Long-term planning/LUMP	C	C	C \\I	I/ C	I/ C
Conception of Sub-projects	A	A	I	I	C /I

Development of "Cahiers de Charge"	A	A	I/ C	I/ C	C /I
2. Planning - Activity Level					
Problem Identification	C \\I	I	C \\I	I	C \\I
Examining Alternative Courses of Action	N A	N A	N A	N A	N A
Preparation/Submission of Proposals	C	A	I	I/ C	I
Selecting proposals	A	A	C	I	C
3. Implementation					
Letting Contracts	N	N	C /I	I	C
Labor	C	A	A	A	A
Technical Assistance	A	A	I	C	C
Managing Activities (Sub-Project)	C	I	I	I	I
Monitoring Activities	A	A	I/ C	I/ C	C /I
4. Other					
Training	A	N A	A	I	C
Environmental Monitoring	N A	N A	N A	C	C
Evaluation of overall project activities	N	N	I	I	C
Relations with exterior (outside project - financial etc.)	N	N	C	I	C /I

CERP team members perceived that villagers and NRMC members were participating fully in the project and cited the PRA and LUMP as proof. They also expressed a certain resentment concerning animators' and NRMC members' tendency to encroach on their purview (technical assistance in particular).

6.6 CBNRM's Approach from the PMU's Perspective

The following table was filled out by PMU personnel as a means to capture the project staffs' perception of how the project should fulfill its mandate to promote participatory development in the NRM sector.

Comments:

The table above as well as an interview with project staff indicates that the staff is dedicated to promoting a participatory approach and to modeling participatory management behavior when interacting with project stakeholders.

PMU staff feel that the LUMPs, the Action Plans (*Plan d'Execution*), and the RFPs (*Cahier de Charge*) all reflect and promote local level needs identification and problem solving. Each planning document is based upon the initial PRAs exercises and LUMPs which are expressions of local level needs. Thus, to continue the project staff's logic and the rationale of the model ODP, the Sub-projects were still valid and responded to grass-root stakeholders' needs. The Sub-project RFPs were developed as illustrative documents to guide local-level stakeholders as they developed and prepared proposals to become the Sub-projects executing agents.

The project developed and trained NRMCS in order to create a CR-level project motor to collaborate with the reinforced CERP teams. These initiatives combined with functional literacy classes all increase CR-level capacity and promote sustainability. The PMU moved away from the *micro-realisation* approach to village-level activities in order to: promote a wider variety of NRM activities (more than Eucalyptus planting and cement compost pits); create synergy between related activities (*poles de developpement*); give women and GIEs greater access to project resources; and to reach a higher number of villagers.

The PMU staff has been working hard to develop local level stakeholders' capacity to act as participatory change agents. PMU staff's description of their interactions with project stakeholders indicate that they model participatory behavior as a means to encourage similar behavior by stakeholders. Staff members described a collaborative approach to working with CERP teams which focus upon transferring skills from PMU staff to CERP members. CR-level stakeholders are expected, in turn, to interact with promoters and villagers in a collaborative manner so that the project will be both empowering and entrepreneurial for village-level beneficiaries.

Operational Definition of Participation - PMU Perspective.

C-	Control (Pouvoir de Decision)
I -	Influence (Appui)
A-	Appreciation
N	- None (neant)

NA - Not applicable

Major Tasks in Project Cycle	R ur al P ro m ot er	Ot he r R ur al Pr od uc er s	N R M C	G o v e r n- m e nt / C E R P	P r o j e c t
1. Planning - Project Level					
Problem Identification	C	C	I	I	I
Analysis of solutions	C	C	I	I	I
Long-term planning/LUMP	C	C	I	I	I
Conception of Sub-projects	I	I	C	I	I
Development of "Cahiers de Charge"	A	A	I	A	C
2. Planning - Activity Level					
Problem Identification	C /I	I	C /I	C /I	I
Examining Alternative Courses of Action	N A	N A	N A	N A	N A
Preparation/Submission of Proposals	C	C	A	I	I
Selecting proposals	A	A	C	A	A
3. Implementation					
Letting Contracts	A	A	C	A	C
Labor	C	A	I	I	I
Technical Assistance	A	A	I	C	C
Managing Activities (Sub-Project)	C	A	I	A	I
Monitoring Activities	C	A	C	I	C
3. Other					
Training	C	C	I	A	I

Environmental Monitoring	A	A	I	I	C
Evaluation of overall project activities	I	I	C	I	I
Relations with exterior (outside project - financial etc.)	A	A	C	I	I

However, the decision-making approach and the physical location of the PMU in Dakar appear to militate against implementing the project in a participatory manner. Decisions such as: shifting from *micro-realizations* to Sub-projects; creating three-year activities which precludes multiple iterations of grass-roots activities within a CR; distributing Sub-projects on a nominally equal basis to each CR rather than waiting for proposal to emerge; and reserving right of final approval for Sub-projects are all examples of a highly centralized approach to decision-making which almost precludes the potential for experimentation (and hybrid vigor) needed to arrive at the best model for this pioneering representative-linked project. The physical distance between the PMU headquarters and participating CRs forces PMU personnel into rigidly-scheduled field visits which precludes PMU personnel being able to adjust to respond to meet evolving needs. Given the time constraints and logistical difficulties of making field visits, PMU personnel are required to resort too often to communication methods which are efficient in terms of time spent but extremely inefficient in terms of empowerment.

7.0 Conclusions

7.1 Overall

- The project is to be applauded for its innovative approach to promoting participatory NRM at the CR level (despite the areas for improvement identified below). All analyses of the project's approach need to acknowledge the difficult environment in which the project operates and that CBNRM is engaged in change processes that require decades to implement.
- The project staff has shown itself capable of learning from its operations and seeks to continuously improve its operations.
- The project's approach in later generation CRs is superior to its approach in first generation CRs which indicates room for optimism.
- The project's decision-making processes are currently too highly centralized which has resulted in CR-level and grass-roots level stakeholders being excluded from the participatory process; project activities which reflect project personnel's approach to NRM rather than grass-roots stakeholders'; and project activities being implemented late which impedes their effectiveness.
- Project representatives have failed to maintain a participatory development approach when collaborating with grass-roots level beneficiaries and have reverted to traditional top-down, directive interaction.
- Project representatives' top-down approach to interacting with grass-roots level stakeholders has undermined the project's efforts to empower grass-roots level stakeholders and has minimized any benefits accrued during the project's initial Project-Level Planning Phase.
- The later generation version of the Project Level Planning Phase more closely reflects the model ODP and appears to include a critical mass of stakeholders (sufficient numbers of people to impact general knowledge of environmental problems) up to the problem identification task of the project cycle.
- First generation PRAs and LUMPs did not include a critical mass of grass-roots level participants sufficient to have a beneficial impact at the grass-roots level.
- The Sub-project approach unnecessarily excludes grass-roots level beneficiaries from the participatory process which minimizes their empowerment.
- Promoters are excluded from the analytical and skill building components of the project implementation phase (analysis of alternative actions; letting bids; managing contracts) which negatively impacts grass-roots empowerment, the relevance of the project activities to promoters' and grass-roots stakeholders' needs, and the project's sustainability.
- The project's implementation process is overly long even in terms of a participatory project and discourages grass-roots collaboration because of the extensive up-front

commitment required. This is especially true since grass-roots stakeholders are not actual partners in the planning and implementation process.

- There are no formal established procedures for identifying and resolving differences between project stakeholders concerning project policies and approach.
- Individual communication from the PMU to the CERP and NRM is generally regular, effective, and promotes participatory development given the constraints on PMU staff time given the project's centralized location.
- Communication from project representatives to the grass-roots level is irregular, ineffective, and is contrary to participatory development.

7.2 Promoter and Grass-roots Stakeholder Specific Conclusions

A distinct dichotomy exists between first and later generation CRs with the trend moving towards improved conditions.

Later Generation CRS

- Sub-committee members link the PRA/LUMP process with Sub-project activities as do grass-roots stakeholders. Stakeholders tend to abide by Sub-Project objectives.
- Grass-root level stakeholders did not have direct input as promoters in the Sub-project design, but they have indirect input through their representatives on the sub-committee and NRM
- Stakeholders appear to understand the proposal process and the amount they are expected to invest in NRM activities (they could explain why there was a large increase from NRM-only contracts to NRM and IGA contracts).
- Stakeholders expressed frustration that the project's processes were not moving faster, and with the large increase in investment requirements due to USAID's refusal to provide credit for IGAs.

First Generation CRs

- For promoters and other grass-roots level beneficiaries, CBNRM is neither entrepreneurial nor empowering.
- Promoters did not make the link between (nor remember) the PRAs and LUMPs with the field-level activities being undertaken.
- Sub-projects do not respond to promoter priority felt needs and no attempt was made to determine their specific needs.
- Promoters are neither expected nor allowed to provide input into sub-project planning and implementation activities and some have been faced with exclusion from the project when they show individual initiative.
- Promoters view their role as laborers (or labor bosses) who are to implement activities as instructed by project representatives and they are to invest their own funds up-front for the privilege.

- Promoters neither understand why they are investing in project activities nor how the project arrived at the amount they must pay.
- Promoters generally expressed frustration or resignation with the project and the work done at the grass-roots level to date. A significant number view the project as a net financial loss (money invested with little or no on the ground activities taking place) to date.

7.3 Local-level representative (CGRN, Sub-committee) level conclusions:

- The initiative to develop and train the CR-level NRMCs and zone-level Sub-committees is excellent. The project decentralization model is worthy of emulation when USAID/Senegal develops new SO2 activities.
- The initiative in later generation CRs to give more operational responsibility (empower) the zone-based sub-committees appears to be an improvement over targeting the CR-level NRMC. Sub-committee member selection has been superior in later generation CRs and the sub-committees themselves seem to be viewed as legitimate representative-links to the PMU.
- Project representatives play an active, though somewhat limited, participatory role in the project's analytical, planning, and implementation phases.
- The project is empowering for local level project representative members because they have been given the skills to acquit their responsibilities as they envision them (though the PMU limits them unduly).
- NRMC members have used their skills in activities other than the project's and are endeavoring to improve governance at the local level.
- Committee members were able to bring a sophisticated level of analysis to the question of participation and of sustainability. They cited visits to similar projects in other Sahelian countries and expressed the desire to increase their role in project affairs as per the examples they saw elsewhere.
- The project is not entrepreneurial for local level stakeholders (NRMC, Sub-Committee members) because the project does not always respond to rural producers' needs and because the project has a history of not implementing activities in a timely manner when it does respond.⁵⁹

⁵⁹ The project's difficulty in accepting IGAs as a legitimate component of NRM was often cited by NRMC members as an example of project intransigence. The project's failure to allow for timely delivery of tree seedlings for two years running was cited by members when discussing the project's failure to work within Senegal's agricultural calendar.

- Despite receiving training and resources, and on-going support from the PMU, NRMC members in first generation CRs do not generally fulfill their role as change agents and as communication links with promoters and villagers.
- The project's nuanced approach to NRM is not transmitted to the village level by NRMC members. PMU-generated suggestions are translated into orders; "illustrative" documents become required workplans; and brainstorming sessions are viewed as empty exercises.
- Promoters and villagers are not treated as partners in the development process by NRMC members.

7.4 CERP Level Conclusions:

- The initiative to train and equip CR-level CERP teams is excellent and is also worthy of emulation under other SO2 activities.
- The project's approach is empowering for CERP members though not entrepreneurial.
- The CERP team members are the stakeholders at the local level whose participation level is the highest because they interact most closely with the PMU members.
- The project has provided CERP members with the training, resources, support, and vision necessary to fulfill their role as partners with villagers in a participatory development process now and in the future.
- Despite receiving extensive training, resources, and on-going support from the PMU - CERP members do not fulfill their role providing technical assistance; acting as change agents; and acting as a communication link with promoters and villagers.
- The project's nuanced approach to NRM is not transmitted to the village level by CERP team members.
- Promoters and villagers are not treated as partners in the development process by CERP members.

7.5 PMU Level Conclusions

- The PMU field staff are generally interested in promoting participatory NRM at the grass-roots level and continue to search for ways to improve the project's participatory approach.
- The project's decision-making processes are too highly centralized and the project's trend appears to be towards more centralized decision-making which is counter-productive.

- The PMU field staff generally models participatory, collaborative behavior during its interactions with project stakeholders.
- The PMU office's location in Dakar is counter-productive and makes the implementing the project using a participatory approach very difficult.
- The PMU is aware of many of the project's short-comings concerning the top-down nature of project representative - beneficiary interactions and is taking steps to correct them.
- The PMU is also aware of many of the project shortcomings concerning the quality of technical assistance delivered by project representatives at the village level and it is taking steps to correct them.
- The PMU's decision to assume greater responsibility for direct service delivery at the village level in response to the two conclusions listed above, while understandable, runs counter to the project's design assumption and risks disenfranchising CR-level project stakeholders.
- PMU staff does not enjoy a collaborative relationship with USAID/Senegal personnel which is essential when running an experimental, innovative, and large project such as this one.
- The project does not seem to schedule events based upon grass-roots stakeholders' calendars. For example grass-roots stakeholders indicated that the Sub-project process was introduced to them in the middle of the rainy season during which time they were focusing on their field crops. In addition, project investment needs were not timed to coincide with periods of the year when stakeholders had cash available.

7.6 Results at the Grass-roots Level

- The trend in later generation CRs is towards greater empowerment of grass-roots level stakeholders than in first generation CRs because the PMU has learned from past experience and improved its approach.
- PRAs and resulting LUMP are superior in later generation CRs
- The sub-committees are more representative than NRMCs in first generation CRs and appear to be in a position to more effectively continue the project's participatory approach at the grass-roots level.
- Very few grass-roots level activities have been initiated under the project's auspices except for a limited amount of functional literacy training and their impact to date has been negligible.
- The team witnessed minimal spread effect for all activities.
- Grass-roots level activities are often marginally relevant to promoters' and villager priority needs and interests. Congruence between promoter needs and Sub-project objectives often occurs through happenstance and not through conscious attempts by project representatives to customize project activities to meet beneficiaries' needs.

- Activities are often neither designed nor implemented to reflect grass-roots level stakeholders' managerial, financial, and technical capacities.
- Grass-roots level stakeholders' risk profiles do not appear to be taken into account when planning and implementing Sub-project activities.
- Promoters feel little ownership for the activities for which they are ostensibly responsible.
- The project's evolving policies have not been explained to promoters and villagers by project representatives.
- The project's credibility with grass-roots stakeholders is hurt because the stakeholders do not understand the conditions under which they collaborate with the project and why their cost of participation increases with each change.

8.0 Recommendations

The following recommendations are divided into two main sections. The first section pertains to project - beneficiary interactions and how the project needs to ensure that the projects' policies and approach are being adhered to at every level. The second section pertains to project policies which should be reviewed, revised, or changed to bring project policies and its operating environment into line with the needs of a participatory project.

8.1 Project Representative - Beneficiary Interactions

This section's recommendations stem from the five following assumptions and conclusions:

1. The PMU is dedicated to promoting participatory NRM at the grass-roots level.
2. The PMU has, to the degree possible given time constraints and ever-changing program policies engaged CR-level stakeholders as partners (intermediary representatives) in the participatory NRM process.
3. The project will not achieve sustainable results unless it succeeds in maintaining its participatory NRM approach down to the grass-roots level.
4. Responsibility for maintaining the project's participatory NRM approach down to the grass-roots level lies with CR-level project stakeholders (NRMC members, Sub-committee members, the Animators, CERP team).
5. CR-level project stakeholders are not engaging promoters and beneficiaries as partners in the participatory NRM process.

The PMU should use PRA tools to identify and then empower representative bodies at the grass-root level to fulfill the representative-link function for the project.⁶⁰ The representative bodies will vary by, and within, CRs.

The breadth of CBNRM's intervention in comparison to its personnel and resources precludes replicating the village-centered, direct-link model of other participatory NRM projects. Based on the palpable improvement of project - beneficiary relations between first and later generation CR's, CBNRM must focus its efforts at the highest level (i.e. largest number of participants) at which grass-root stakeholders perceive that they are being legitimately represented by intermediaries.

⁶⁰ The term "grass-roots" is used here to denote the level at which an effective representative-link model can be established. "Grass-roots" can therefore denote "Federation" level; "Zone" level (as represented by CBNRM's Sub-committees) or some such configuration.

The PMU needs to analyze, in collaboration with grass-roots participants, which level of intermediary representation is appropriate for each CR. PRA tools such as the "Polarization Diagram" can provide CBNRM members with insight into an area's current associations and representative bodies upon which CBNRM can build or to which CBNRM can bring support to fulfill the representative function.

The PMU will need to accept, and should embrace, that different representative structures will emerge in each zone of intervention. The NRMCs, Sub-committees, federations, or even inter-village tontines may be designated by populations to represent them. Once an intermediate representative body has been selected to provide the necessary linking function for the project, the PMU will need to target that group for training and resource support in lieu of focusing exclusively on the NRMCs.

The PMU should avoid assuming greater responsibility for direct service delivery at the grass-roots level and should instead improve representative-level technical and participatory development capacity.

CERP and NRMC members indicated that the PMU did not work as partners with them and that too many decisions were made at the Dakar level. Whereas these comments are common to mid-level managers in a hierarchical work environment such as the project's and are to be expected; the PMU's decision to take an increasingly important role in direct service delivery to the grass-roots level will open it up to charges of increasing centralization of decision-making authority within the PMU.

PMU staff members' decision to assume greater operational responsibility is understandable given their valid analysis that services being delivered to the grass-roots level are not generally of acceptable quality. Though the centralizing strategy is more efficient in the short-term, it will compromise the project's long-term ability to promote sustainable NRM activities.

The PMU staff should review the following recommendations as a means to promote representative-level capacity.

Create a monitoring and companion incentive system including grass-roots level monitoring to align project representatives' interests with the project's participatory approach.

Project representatives reverted to traditional leadership form during most of their interactions with village-level stakeholders. Since project representatives have been given extensive training and support in participatory development behaviors (to be reinforced by the series of recommendations below), their failure to display collaborative behavior may be due more to their

unwillingness to change than their inability.⁶¹ In short, the project may be faced with a personnel management problem rather than a training problem.

Since one of the project's design assumptions is that CR-level personnel will perpetuate the project's participatory approach when linking with grass-roots participants, the project should have a monitoring system in place to determine the validity of the assumption. CERP members all indicated that their *Direction* placed a great deal of importance upon their collaboration with the project so such evaluations have a high likelihood of influencing CERP team members' comportment.

The project's monitoring staff would be charged with driving the design and implementation of the "participatory development performance" system. The monitoring staff should regularly visit stakeholder groups (starting with grass-roots level groups) to gather information on participatory performance indicators such as:

- how closely the project adheres to the participatory approach (including "post-PRA")
- grass-roots level stakeholders' comprehension of the project's philosophy, approach, and implementation plan at the local level
- grass-roots level stakeholders comprehension of Sub-project objectives and importance if such to their priority needs
- determine project representatives' participatory performance (number of visits, ability to relate visit to overall project objectives, communication skills, willingness to engage in negotiations, etc.)

Since grass-roots level stakeholders are the project's ultimate client, the project should give them the opportunity to drive customer satisfaction procedures in which they evaluate project representatives' performance. In all, the creation of an evaluation system will have the following positive results:

- Specific evaluation criteria helps project staff to precisely communicate their expectations to project representatives.
- Precise standards lead to clear communication between project stakeholders.
- The evaluation criteria will be used to drive the "customer service and empowerment" training courses recommended below.
- Grass-roots level stakeholders will be empowered because they, too, will understand what is expected of project representatives and they will understand that they have the right to demand a minimum level of service from project representatives.
- Project staff will have the means to measure quality and undertake corrective action when necessary.

⁶¹ Project representatives may also be over-extended because of unrealistic workloads.

- CBNRM will have another model for the promotion of good governance at the grass-roots level from which USAID, the GOS, and other donors can learn.

Maintain the participatory process throughout the project cycle rather than ending it after the Problem Identification phase.

- **Increase grass-roots level stakeholder's role as partners in the participatory NRM process by including them in all tasks especially:**

...the design of grass-roots level activities

Unless promoters and other villagers have the opportunity to participate in the design of grass-roots level activities, the activities will neither meet their priority needs nor will they claim ownership of the activities which is essential if they are to be replicable and project benefits sustainable.

Designing Sub-projects at the CR level brings the process physically closer to villagers but still does not engage them in the analytical process in a way that will acquire the skills and confidence necessary to replicate the process on a sustainable basis. Promoters will only acquire the skills and confidence necessary to sustain the participatory process through practical experience in collaboration with project representatives.

In theory, the Sub-project approach replicated the RFP bidding process in that grass-roots groups coalesced around a proposal preparation process during which time the group would determine if the RFP would respond to a felt need and to develop a proposal in response to that felt need. In reality, grass roots participants played a negligible active role in the process.

A superior model would be to open a bidding process at the CR level without developing Sub-projects. Promoters would be open to proposing activities which respond to their felt needs. The CR-level representatives (a combination of NRM (the majority, *Conseil Rural members*, and CERP members *ex officio*) would be the decision-making body empowered with funding, revising, rejecting, or finding alternative funding for proposals. The funding committee could meet on a regular basis to review proposals which would be evaluated on pre-determined criteria including how they respond to (and reference) the LUMP; the legitimacy of the grass-roots executing agent (pre-existing organization, federation etc.); feasibility etc.

This decentralized decision-making model has been successfully implemented throughout the Sahel. The PMU's involvement in grass-roots level design and development of activities would be drastically reduced which would increase the number of activities which could be undertaken. The model would increase the number of activities which could be financed under the project's

auspices and would allow the project to realize a spread effect as grass-roots stakeholders become emboldened by the success of early adopters.

...the management of grass-roots level activity contracts

To date promoters interact as passive consumers with vendors and service providers who have been selected and engaged by the project. Promoters need to learn about the mechanics of bidding; developing and signing contracts; and managing service providers if they are to continue development activities on a sustainable basis. The project needs to act as guarantor, mentor, and trainer to promoters as they learn these skills under the project's auspices. Once again, project representatives, and not the PMU, would fulfill this role for the project.

• Target more organizational management training to promoters -

Sub-project promoters are currently passive project partners whose capacity is in no way being enhanced. The project's effective training program at the CR level has not trickled down to the grass-roots level. The PMU, as part of its continuous improvement process has already planned training programs in NRM techniques, financing options, and management training for Sub-project constituents for 1999. This is an excellent initiative which should be increased and reinforced. Targeting promoters for human resource development will provide a cost-effective means to spread project benefits to the grass-roots level without having to conduct widespread training at that level. Training topics should include those found in the series of recommendations found above.

Training must be based upon adult education principles which does not appear to have been the case according to expert analysis of early training programs. Topics must be of immediate use for participants; training must include a mix of theory with practical applications; trainers must approach training participants as partners; and participants must be given the opportunity to analyze and discuss training subject matter based upon their personal experiences.

• Create project-wide tools and protocol for operationalizing participatory development at the grass-roots level -

The PMU staff has started several initiatives to reinforce the participatory process at the grass-roots level. For example, staff discussed creating participatory maps at the grass-roots level which will help promoters and other stakeholders understand Sub-project activities and interventions. Such initiatives need to be supported and added to.

...Tools

There are a wide variety of tools which can assist illiterate (or pre-literate) villagers to understand and master complicated project processes. For example,

- Pictorial representations on flip-chart paper of:
 - % the project's approach from initial site visit through to evaluation of grass-roots level activities,
 - % priority activities as developed during the LUMP ,
 - % grass-roots activities and how they relate to the LUMP,
 - % grass-roots stakeholder-generated maps of their *terroir* (defined here is area of economic activity). Stakeholders can generate "before" and "after" maps to indicate what grass-roots activities are planned as well as anticipated outcomes.
 - % Technical materials (*fiche techniques*) for planned activities.

Project drawings can be covered with clear scotch tape (grass-roots level plastification) and archived with the promoter for easy and repeated reference.

- "Spoken" project documents as recorded on cassettes in local language. Subjects and "spoken documents" should include:
 - % all subjects listed above,
 - % minutes of any grass-roots level activity including major meetings (who attended; what was said; decisions taken; next steps); objectives; plans; progress; contractual obligations etc.
 - % all contracts,
 - % summaries of all project representative - grass-roots stakeholder interactions (guest book). Both the project representative and a grass-roots representative should provide a summary of the interaction to verify mutual understanding and clarify misunderstandings
 - % crucial project-level policy statements generated at the PMU level
 - % important GOS policy initiatives which impact villagers (Forestry Code, land tenure initiatives, status of GIEs etc.)
 - % evaluations of project representatives
 - % evaluations of grass-roots activities including lessons learned for CR and PMU personnel.

This method for recording project events; for linking current activities to the project's overall process; and for informing beneficiaries has been tested and proven throughout the Sahel and should become a fundamental component of the project's efforts to improve the quality of the project's link to the grass-roots.

An informal survey of all villages visited indicated that cassette players are common (part of a woman's bride price in the Saloun) and could be one of the tools provided by the project to promoters.

- **All project documents (including a guest book) and financial records written in local language or arabic.**

This initiative will reinforce the importance of the functional literacy courses. USAID/Senegal's legal counsel will need to determine whether contracts written in local languages are currently legally binding. The author's initial research indicated that such documents do not currently have legal standing. Possible solutions include simultaneously written contracts with the French copy have standing in case of litigation or having the Mission press the GOS to change its current statutes.

...Participatory protocol

Repetition and reinforcement provide the base of effective learning and should provide the basis for all project representative - grass-roots stakeholder interactions. All project representatives should be required to implement (and will be evaluated based upon implementation of) the following steps when visiting stakeholders with whom the project is collaborating:

- clearly state visit objectives to all concerned stakeholders,
- link all visits to overall project objectives and processes. CR level personnel should refer to grass-roots level archives to re-visit the project's processes and steps taken to date and how the current visit will further that process,
- adopt a facilitator's role whenever possible. Visitors should promote discussion and analysis rather than impose answers from the outside.
- record the visit in the guest book and on tape if necessary.

As mentioned in the conclusions section, the subtlety of communications and the quality of messages was reduced as information was transmitted from the PMU through the CR-level to the grass-roots level. Whereas some of the reason for this can be attributed to the ability of project representatives to communicate, part of the reason can also be attributed to beneficiaries' interpretation of what is being communicated. They will filter information based on their expectations of what will be said, their experience, and what they want the communication to say.

The difference between the intended and the actual use of the Sub-Project *Cahier de Charges* provides a good example of the loss of subtlety in communication as information flows from the PMU to grass-roots level. The *Cahier* was viewed as a guide by PMU staff which would provide suggestions and technical information which CR-level representatives could use when developing their various Sub-projects. At the CR and grass-roots level, the *Cahiers* were used as the technical specifications which drove the Sub-project designs. Thus a document which started out as a facilitative document intended to assist personnel in their work was used and interpreted as providing personnel with their "marching orders".

If project representatives follow a standard communication protocol in which they explicitly link each communication and visit to the project's overall objectives (and in which they refer to recordings of what has been agreed to in previous visits), the quality of what is being communicated and how it is being remembered (and filtered) will increase. The project's credibility has been hurt by the lack of a clear stakeholder understanding of almost every aspect of the project's philosophy and approach. The above protocol will go a long way to minimizing misunderstandings.

- **Reinforce training in participatory development approaches at the CR-level.**

However, CR-level stakeholders have not transferred the project's participatory approach to the grass-roots level which threatens the project's prospects for creating an enabling environment for participatory development at the grass-roots level. If the project institutes a monitoring system to evaluate CR-level personnel's participatory performance, it is incumbent upon the project to develop training programs and workshops to provide personnel with the skills and in the protocols expected of them.

In addition to developing programs to address the initiatives, tools, and protocols listed above, the project's training staff should conduct a workshop in which stakeholders generate an operational definition of the participatory approach akin to the one suggested by the author in this report. The author's experience has shown that such a "participation matrix (or "responsibility matrix") provides participants with a common and precise understanding of the participatory process and their role therein.

- **Include *Conseil Rural* members in CR-level training.**

CBNRM's training at the CR level has been effective to the point that NRMC members are manifestly more qualified than other local-level decision-makers. This difference has created a felt need among CR members for similar training. The project, or USAID, should meet this felt need in order to leverage the benefits of CBNRM's activities at the CR level and in order to create more project supporters.

The PMU has included training for *Conseil Rural* members in the project's 1999 workplan which is another indicator of the project staff's ability to learn from its field experience.

- **Create a communication protocol between PMU and CR-level stakeholders to reinforce participatory communication patterns project-wide.**

The PMU staff should replicate the communication protocol proposed for CR - grass-roots level interactions though simplified to meet the needs of both stakeholder groups. Minutes from quarterly coordination meetings and other encounters should follow a simple

- Problem Statement,
- Discussion,
- Decision,
- Action Steps (or Next Steps)

format which will help to clarify communication. In addition, this format will help track how, and whether, feedback from CR level stakeholders is being noted and acted upon in a timely manner by PMU staff. The author noted in a review of project reporting documents that there is a heavy emphasis in these documents upon description of problems; an occasional suggestion for corrective actions; and almost no indication of actions taken to resolve specific problems. The suggested reporting format would help link problems to their solutions.

8.2 Policy Review

This section will make recommendations which focus on project-level policies as well as upon the project's relationship with USAID.

- **Focus project resources upon implementing project activities in current CRs rather than expanding into new CRs.**

CBNRM was conceived of as an innovative approach to promoting participatory NRM in the Sahel yet the project was designed to intervene in 50 CR throughout the country. Therein is found a contradiction in design logic which has put pressure on the PMU to constantly expand its operations to the detriment of it being able to consolidate its operations in a smaller number of CR and to learn lessons from its experience.

It appears at the time of writing this report that USAID will direct the project to stop its expansion into new CRs which is a positive direction for all project stakeholders.

The project has been dealing with unrealistic expectations from USAID down to the grass-roots level since its inception which has impeded its ability to promote sustainable participatory NRM.

- **Adjust the project's overall planning process to reflect Senegal's agricultural calendar and prioritize activities to coincide with that calendar.**

The staff must give first priority to timely delivery of material and support necessary for villagers to implement time-sensitive grass-roots level activities in a timely manner. CBNRM should develop work plans that are based on grass-roots stakeholders' agricultural calendar rather than on USAID/Senegal's planning cycle. The project staff can make "cross-walk" documents to

meet the Mission's reporting requirements but this should be secondary consideration for the project staff.

In the CRs visited, activities undertaken under the project's aegis which were time sensitive (tree-planting, market gardening) have been delayed to the point that they became exercises in "planned death" to quote a CERP member. Project beneficiaries repeatedly expressed frustration with receiving tree seedlings at the end of the rainy season (exacerbated by poor rainfall) two years in a row and are already concerned about tardiness this year.

Such operational inefficiency, regardless of its causes, will obviate any chance the project has of having a positive impact and must be addressed immediately.

- **Review the project's decision-making processes to determine where the responsibility for decisions can be decentralized.**

The project's tendency to be responsible, or to have PMU staff members participate in, decisions concerning grass-roots level activities is neither operationally efficient nor empowering in the long-term. The PMU's role should be that of:

- % establishing policy guidelines (*Principes Directeurs*) in collaboration with project stakeholders;
- % training stakeholders in the processes required to reach decisions;
- % informing stakeholders about the wide array of activities and technologies which can be used to achieve sustainable NRM;
- % providing the technical and managerial training required to support new NRM technologies at the grass-roots level, and
- % evaluating project representative's performance based upon "participatory performance indicators" recommended above.

CR-level informants universally described having to wait for Dakar's approval for all activities especially if an activity is the result of a local-level initiative. As is the case with promoters, CR-level stakeholders did not feel empowered to make decisions about project activities for which they logically take responsibility.

A case in point would help illustrate the disadvantage to highly centralized decision-making:

A NRMC member who was a metal worker submitted a *micro-realisation* proposal to build and sell metal versions of the improved cookstoves. The proposal quoted a sales price for the cookstoves to which the metal worker would adhere (he proposed the price). The metal worker viewed the activity as a way to promote a public good and as a short-term loss leader which he would use to create a demand for cookstoves. He would recoup his losses by satisfying the

demand for metal cookstoves which his activity would create. The NRMCA approved the proposal but the PMU (through its agent ACA) rejected it after conducting a cost-benefit analysis of the proposal.

Whereas the merits of this specific proposal are open to debate, the case is mentioned here because it is representative of CR-level stakeholders' comments concerning how the locus of decision-making power is found too often at the PMU level. The centralization of decision-making power negatively affects CR-level participation and empowerment; local-level research and experimentation; and the strength that comes from diversified CR-level and grass-roots level activities.

• **Review the impact of the Sub-project approach, especially in first generation CRs, and revise or abandon the approach for later generation CRs for a more entrepreneurial and empowering approach**

The Sub-project approach should be reviewed in light of its impact at the grass-roots level in the first generation CRs and other means explored for achieving sustainable, participatory NRM in those CRs.

The PMU's decision to move from a *micro-realisation* to a Sub-project approach was undertaken to respond to its analysis of the weaknesses of the former approach especially in terms of the preponderance of old-style interventions (woodlots), the dominance of individual males, and the minimal number of villagers impacted by the activities.

Whereas the objectives for moving from a *micro-realisation* to a Sub-project approach are good (encourage/require a diversity of activities and increase the number of grass-roots stakeholders impacted), the means chosen for achieving the objectives is not especially effective in the first generation CRs for the following reasons:

- % the PRA exercise and resulting LUMP have been forgotten by the vast majority of promoters interviewed (who are key collaborators with the project),
- % project representatives have made no link (or informants do not remember a link being made) between Sub-projects, the LUMP and even the *Plans d'Executions*,
- % in CRs outside of the Fatick region, the "federations" of which the promoters are representatives are only facades which have been created by project representatives to respond to the project's directive to work through federations,
- % all analytical work conducted during the Sub-projects took place at the CR-level and above thereby excluding grass-roots stakeholders from the crucial early steps of the project cycle in which their participation is key to ensure their buy-in, that the activities respond to priority needs in an appropriate manner, and that they learn the skills necessary to make the process sustainable at their level.

As a result, promoters have been reduced to the role of policy endurers in first generation CRs. In most instances, project representatives have controlled most every aspects of the project design and implementation process with promoters acting as executing agents with little or no power to understand or influence what is being done.

The project should revise its approach to promoting grass-roots level activities to ensure that the approach adheres more closely to the participatory process and that grass-roots stakeholders become active partners in the process through all its phases. Part of the solution to promoting the participatory process will be to improve the quality of CR-to-grass-roots communication as recommended above. However, the project needs to create a planning and design process which includes promoters in that process. How this will be done will be determined where in the process each Sub-project is found.

Mid-term evaluations for first generation CRs - since most Sub-projects are in their second year of operations, project representatives should work with promoters and federation members to conduct a process and an impact evaluation of activities to date with an eye to revising the remaining activities to better meet felt needs. Project representatives will need to stress that promoters have the right to revise Sub-project activities based upon their evaluation but that the project will not be able to increase the amount of money it will invest in a given project. Part of the evaluation process should be devoted to having stakeholders try to link the Sub-project to the local LUMP and *Plan d'Execution* to reinforce the grass-roots level protocol approach.

Later generation CRs - since most Sub-projects have not been initiated, project representatives should meet with promoters and other stakeholders to review the Sub-projects to determine if they meet stakeholders' priority needs and to determine the degree to which the approach has helped empower them. As noted above, the authors are more confident that the later generation's framing documents (PRA/LUMP/Work Plans) are more legitimate than in first generation CRs and the results of the review are more likely to be positive.

The project must stand ready to revise activities in response to grass-roots level feedback. The PMU should then institute the CR-level activity selection process recommended above in which the CR-level select proposals which are generated in response to the LUMP and not to the *Cahier de Charge*.

- **Review/revise definition of NRM activities**

The tendency to narrowly define natural resource management as a series of activities (tree planting, soil conservation, etc.) that is separate from income-generating activities is counterproductive to understanding rural producers' needs. It is more useful to think of, and promote NRM, in terms of food security: whether an activity will add to the wide variety of rural

producers' food security strategies which they employ to live in a precarious environment. Thus, a NRM project can legitimately collaborate with rural producers to respond to their demand for assistance to develop local cereal banks wherein rural producers can reduce their exposure to the risk of fluctuating millet prices. By reducing rural producer risk, a NRM project has improved their ability to marshal their resources which will put them in a better position to adopt other NRM strategies which might have medium and long-term food security, and NRM, benefit.⁶²

Rural producers are practical and their decision to adopt an activity is driven by the immediacy of their needs and the ability of an activity to help them meet their needs without requiring them to assume undue risk. Since,

- most (though by no means all) rural producers depend primarily on rain-fed crops as their first source of food and income,
- most agro-ecological zones in Senegal are marked by highly variable rainfall in both time and space,
- soil fertility is the primary constraint to increased agricultural production and
- soil fertility has been falling steadily for the last 20 years,

most rural producers seek to diversify their risk through complementing NR-based production with income-generating activities on a small scale. As such, NRM projects should include (and regularly add) income-generating activities in their portfolio to reflect rural producer's demands which are designed to complement their risk-spreading approach to food security.

Rural producers are most likely to adopt a practice if it will improve output (cereal crop yields, animal production, vegetable production) and will produce results in the short-term (by the next harvest) as well as long-term benefits. Accordingly, NRM practices most likely to be adopted are those that help conserve and replenish soil nutrients, that reduce runoff and increase infiltration and available soil moisture, that increase soil organic matter and positively influence soil moisture holding capacity and cation exchange capacity, and protect soils against degradation from wind and water erosion in the short and medium term. Medium and longer-term production benefits include production of poles, fuelwood, raw materials for household implements, fodder, edible leaves, fruits, and medicines, and a range of other locally consumed and marketable products.

"Increases crop production" was not only cited the most often by rural producers during the course of this assignment (as well as in other similar studies throughout the Sahel as cited here) as the first benefit of adopting a NRM practice, but it is given as the first reason the most often. Other similar short-term production benefits such as increasing revenue, diversifying food and

⁶² As an aside, projects should not try to impose the creation of cereal banks in an area where rural producers never sell their cereal crops because they are used to promote mutual assistance within the village (as is the case in Fissel).

revenue sources, and increasing animal production are all variations on the same theme that next year's harvest and this year's needs predominate. Clearly short-term benefits are highly motivating factors but villagers are also concerned with sustainability issues.

Longer-term interests (increases soil fertility, reduces wind erosion, increases fuelwood, increases wood for construction, pharmacopia, etc.) are expressed quite frequently by villagers but usually as a second, third, or fourth criteria. The range of responses shows that villagers evaluate activities from a multitude of perspectives. Since few villagers specialize in one activity, most evaluate activities in terms of multiple benefits which not only increase but also diversify their resource portfolio. Thus, rural producers are interested in maintaining and improving their resource base, increasing their yields, and increasing the sources of income, to satisfy immediate needs (and to prepare for the next bad year).

- **Provide credit, or access to credit, to support villagers' food security strategies**

Successful participatory NRM projects throughout the Sahel do not separate out NRM activities from income-generating activities (IGA) because villagers do not separate these activities in their own world view.

The PMU should:

- % review its current budget to determine where funds can be re-directed to providing support for IGAs,
- % re-introduce a revised and reduced pilot credit scheme to USAID/Senegal for review,
- % explore how to link NRMCs with local financial institutions or credit projects to facilitate villager access to credit.

USAID should:

- % revisit its decision to deny the project a credit component and find the means to add this component to the project's operations. The Mission should consider an incremental approach to establishing a credit program based upon the KAED model.
- % explore how to link CBNRM with local financial institutions or credit projects to facilitate project access to credit.

- **Revise the project's CR-level project cycle to reduce time between the beginning of the planning process and the implementation of village-level activities.**

The participatory planning process is by necessity a long process given the need to reach consensus between a wide number of stakeholders concerning priority problems and possible solutions to these problems. In addition, stakeholders must often acquire the baseline skills

necessary to implement the process. However, strict adherence to the process can cause a high degree of grass-roots stakeholder frustration and cause them to reject the project outright before it gets to the implementation stage. Such is the case in this project.

The above recommendation can be achieved through two means:

...move locus of decision-making for grass-roots level activities to the CR and grass-roots level

The project's Sub-project approach places too much responsibility at the PMU and CR level which impedes the project's ability to support the planning and implementation of village-level activities. Moving the responsibility for planning and implementation to the grass-roots level would allow the PMU to assume a facilitation role and would create the enabling environment in which stakeholders acquire the skills necessary to continue development activities after the project's termination.

...develop easy-access collaborative activities to complement the participatory process

Many participatory projects in the Sahel develop a series of activities which the project can undertake in collaboration with grass-roots stakeholders which require minimal commitment of resources on both sides. These activities perform three functions,

- % they help to assuage impatient stakeholders as they work their way through the longer term participatory processes and allow for a "quick victory" in which stakeholders reap some benefits from collaborating with the project in the short term.
- % communicate to grass-roots stakeholders that the project understands their needs and expectations and works to find mutually agreeable solutions, and
- % communicate to stakeholders that the project understands how they experiment and adopt new technologies and ideas through small-scale "pilot projects" which minimize risk.

These activities are generally implemented on a *quid pro quo* basis which avoids cash payments which can create false expectations on the villagers' part. Possible activities for the project include:

- % a version of the "Jig-Jam" promotion of natural regeneration idea in which village, *terroir*, federation, or CR level control of tree cutting (with attendant ability to levy fines etc.) is devolved from the Forest Service to private citizens.
- % a version of Winrock's Seeds for Trees in which villagers receive a certain amount of improved seeds if they agree to protect natural regeneration in their fields (trees can be marked with paint for verification purposes),
- % support (seeds or other input) for adoption of improved cookstoves

- % support for adopting improved pruning techniques (*elagage ameliore*)
- % partial support for a functional literacy class for a year pending project collaboration with the village.

● **Explore linking with more traditional direct-link projects which can focus more project resources at the grass-roots level**

USAID and CBNRM should conduct an environmental scan to link with current and planned projects that plan to use a more traditional village-based participatory NRM approach. CBNRM has been charged with finding new ways to scale up the benefits of participatory NRM approaches. The partnership between CBNRM and direct-link projects would provide a complement to the project's experimenting with a wide variety of representative-link models and would provide more lessons from which to draw the best models. In addition, CBNRM and USAID would be leveraging resources to multiply the project's benefits and will be exploring another means to promote sustainable NRM on a national level.

USAID should consider designing upcoming SO1 and SO2 activities to play this linking role with CBNRM. For example, there appears to be a natural complementarity between the KAED project and CBNRM which merits being replicated in the near future.

● **Create USAID-project communication/consultation link to improve relations**

CBNRM and USAID personnel need to establish a forum for regular, issue-based discussions. Since CBNRM is engaged in an innovative experiment in scaling-up the benefits of participatory NRM, the PMU and Mission need a forum in which issues can be raised in a collaborative environment which will foster innovative thinking.

Project personnel displayed both "error-embracing" and "error-denying" behaviors in its reporting documents and in interviews with team members. The latter behavior stems from operating in a hostile environment in which problems are equated with failure and incompetence. The result of such behavior is a tendency to ascribe blame and an inability to understand the root cause of problems as well as their long-term solutions.

The former behavior is manifested in collegial environments in which problems are accepted as the natural outcome of human endeavor and are viewed as the means by which continuous improvement can be achieved within an organization. The result of such behavior is an increased ability to think critically which leads to long-term organizational improvement.

Since project and Mission personnel expressed frustration with the state of collaboration between the two entities, the two parties should take the opportunity presented by this report to agree to

meet on a regular basis to discuss the project's strengths and its areas of improvement in order to move towards a mutually-beneficial relationship.

- **USAID should designate a Single Point of Contact to act as liaison with the project**

In anticipation of the recommended forum, USAID personnel must also designate a SPOC (be it one person or a steering committee with members from SO1, SO2, AME etc.) through whom all official Mission positions are communicated to the PMU. Mission expectations and policies need to be coordinated through the SPOC to minimize the danger of sending the PMU mixed signals.

- **USAID needs to determine its policy towards wide-spread destruction of forest areas in the Kolda region**

Informants in the Kolda region, mainly Pulaar-speaking people, expressed extreme frustration with the environmental refugees from the Sine Saloum regions who are moving south in ever-increasing numbers to occupy protected forest areas in the Kolda region. These villagers from the north are clear cutting forested areas. Charcoal cutters have also moved into the area and are cutting down large forested areas with, according to local informants, the complicity of Forest Service personnel.

The benefits of project-level NRM activities will be negligible in comparison to the destruction of forested area as caused by these refugees from the north. USAID, and the project, need to decide if the project is willing and able to promote region-level protection activities (*mis en defens*) since such activities were given high priority in the LUMPs.

The disadvantage of undertaking such activities is that the project will be entering into a politically fraught arena. The disadvantage of inaction is that the project risks becoming marginalized to the point of irrelevance in the Kolda region (and in the country as a whole).

9.0 Overall Implications and Recommendations for Future Nrm Activities - Lessons Learned

The following recommendations are organized into three groups. The first recommendations focus on project design issues. The second group of recommendations address how USAID should use the Strategic Objective approach to more effectively link activities to achieve a greater impact in the NRM sector. The third group of recommendations address how USAID should use its resources to improve the policy environment in which donor activities are being implemented.

9.1 Recommendations Concerning Project-Level Designs

Characteristics of Decentralized, Participatory NRM Projects

Given the assertion at the beginning of this report concerning the need for NRM projects to be entrepreneurial and empowering, the following is a list of ideal characteristics of a decentralized, participatory NRM project:

1. Rural producers, and not the environment, are the focal points of the project's operations.
2. The project operates in line with the rural producers' priorities (even if activities are not directly associated with western concepts of NRM) and at their rhythm.⁶³
3. Rural producers are the primary decision-makers and catalysts for planning and implementing activities.
4. Rural producers are engaged in all the project's cognitive, financial, as well as physical, functions as the only means of confirming that project activities meet rural producers' priorities.
5. Rural producers and projects enter into contract-based partnerships wherein the rights and the responsibilities of all potential actors are clearly defined and scrupulously respected.
6. The level of project-rural producer collaboration increases incrementally and is dependent upon initial small-scale successes.
7. Each partner's knowledge is respected. The project staff uses a learning systems approach to management.
8. New ideas and technologies are tested by rural producers on an experimental basis and evaluated in a problem-solving mode.
9. The project collaborates with, and re-enforces, CBOs. In the absence of a viable CBO, project staff works with rural producers to establish and run such a local-level representative entity.

⁶³ From "Review of Lessons Learned".

10. Project-supported rural producer activities reflect their managerial, financial, and technical capacity.

As such, government technical services and project staff collaborate with rural producers to plan and implement activities which tend: to be small-scale and low-cost; to provide short-term or medium term benefits; to be an adaptation of an existing local practice; and tend to help rural producers diversify economic activities in order to reinforce their food security strategies through spreading their risks.

The following are conclusions about specific aspects of the USAID/Senegal's NRM projects which impact their ability to promote sustainable NRM and recommendations for improvement

Conclusion: Projects are not given sufficient time to realize their objectives.

Most projects require at least five to ten years to achieve sustainable results. The Rodale and Winrock NRBAR activities were too short to create an iterative process between participants and researchers. The KAED project was not fully functional until its fourth year of operation and the CBNRM project is still experimenting with an innovative approach to promoting participatory NRM at the CR level. In each instance, projects have achieved positive results which need to be consolidated and supported in order to be sustainable.

Recommendation: Design NRM projects with a ten year time horizon.

Conclusion: Projects Fail to Respect the Participatory Process Throughout the Entire Project Cycle

None of the projects reviewed were participatory throughout the project cycle to the point that beneficiaries were sufficiently empowered to replicate development activities from beginning to end without project assistance. The Rodale and Winrock NRBAR programs were essentially extending technologies from project to villagers with little feedback being sought. KAED started well as a participatory project but precluded villagers from establishing contractual relations with service providers.

The grass-roots level reality for CBNRM promoters in the first generation CRs is that they are currently passive recipients of project assistance for which they must invest a certain amount of money up-front. It must be noted that there is room for optimism in the later generation CRs since many of the conditions which precluded participation have been changed.

As mentioned above, the projects' failure to use a participatory approach throughout the project will negatively impact their long-term impact on project beneficiaries as well as the prospect for the continuation of sustainable NRM practices.

Recommendation :

USAID/Senegal personnel, as part of its customer satisfaction survey process, should conduct RRA/PRA exercises with project stakeholder focus groups. USAID should develop a matrix similar to the ODP to facilitate participants' analysis of the project's participatory approach. USAID would review the results from surveys in collaboration with project personnel to evaluate how the project's operations are promoting or impeding the participatory process and sustainable development.

USAID should give particular attention to decision-making trends as a project gains experience. Project personnel often have to compromise in the short-term and assume more decision-making power than they would like given participants' expectations concerning the project's leadership role. USAID should encourage project staff to review its decision-making processes on a regular basis to determine if it is becoming more decentralized as participants become empowered and more capable of fulfilling their roles in the process.

Conclusion: Projects have a tendency to impose project agendas on villagers

Rodale, Winrock, and KAED all collaborated with villagers based upon a pre-determined list of project activities to be undertaken. The former two projects adhered to their pre-determined lists whereas KAED deviated from the list and was somewhat open to village-level innovations.

CBNRM did not have a list of pre-determined activities during the *micro-realisation* phase of village-level activities but ended up receiving proposals which were almost exclusively for Eucalyptus plantations and cement compost pits. The PMU's response was to create RFPs for Sub-projects which were based upon the LUMP and *Plan d'Execution* findings.

Recommendation:

Establish a coherent project policy environment which promotes individual initiative while respecting the project's limitations

Whereas all projects must stay within their mandated sector, they should provide participants with the most latitude possible to analyze problems and develop their own solutions to NRM problems. In addition to including participants (either directly or through legitimate representatives) in all phases of project planning, projects can establish the framework within which participants can operate by:

- requiring participants to justify their activities in terms of project objectives, and LUMPs (if they exist),

- developing a list of illustrative initial “turn-key” activities (promotion of cookstoves, protection of natural regeneration, etc.) which require little investment and planning but which allow for a “quick collaborative victory” for the project and participants
- developing a wide variety of illustrative (but not exclusive) activities which can be proposed to the project,
- developing scenarios (recorded on cassettes) which demonstrate how the project will (and has) supported participants proposals for activities that were not found on its illustrative list but which meet project objectives and LUMP priorities,
- instituting local-level review committees to select proposals for implementation.
- requiring that participants invest in all participant-led activities on a graduated level,

Please note that all the recommendations above are based upon previous successful participatory projects throughout the Sahel.

CBNRM’s experience has shown that the NRMCs are in a position to potentially fulfill the last two tasks which is extremely encouraging. They have not yet been able to realize their potential because the PMU has not yet fully devolved this decision-making responsibility to the NRMCs. The author is fully confident that, given the project’s overall commitment to learning from its experience, the PMU will fully invest later generation NRMCs with decision-making power in this domain.

Recommendation: Abandon the artificial distinction between NRM and income-generating activities in favor of adopting an approach which promotes sustainable food security strategies

Examples of this approach abound in the Sahel from which USAID/Senegal should draw up a “best practices” list of acceptable activities for use by projects. CR-level stakeholders in the CBNRM project lamented that they had participated in study tours to other Sahelian countries in which they had seen the wide variety of activities that are possible under the NRM rubric only to be prevented from applying their lessons learned upon returning to Senegal. The irony and the de-motivating impact of this situation should not be lost on the PMU and USAID and must be redressed as quickly as possible.

Conclusion: CBNRM’s CR-level approach to promoting democracy and governance activities should be replicated under USAID planned SO2.

CBNRM’s experience demonstrates that projects can promote good governance at the CR level, but only if the adoption of such good products is the by-product of other, more practical, activities.

Recommendation: Imbed D/G activities within larger, service-delivery projects.

Former Speaker of the House Tip O’Neil reminded all who would listen that all politics are local. CR-level D/G activities must be promoted as the means by which more practical ends (deciding upon funding proposals for IGAs, etc.) are achieved rather than as an end in itself.

Conclusion: In the current environment, government institutions must be given a specific role in project implementation

The author’s personal experience and evidence from the KAED and CBNRM projects demonstrates that, in the absence of private sector service providers, local government officials must be given an active role in project activities to obtain their buy-in. Failure to cede a specific role to government institutions usually leads to government agents rejecting project initiatives once the project ends.

Recommendation: Develop a Mission-level policy concerning GOS involvement in projects to which projects must adhere.

USAID should use the ODP table in negotiations with the GOS to clearly articulate the role officials will play in project implementation. Experience in other francophone countries and with other donors indicates that GOS officials are willing to accept the role of “technical assistance” if they are provided with resources to fill this role.

The CBNRM experience demonstrates that government officials can play an active role in participatory NRM projects and provides a model for USAID/Senegal. However, officials’ effectiveness and commitment to the participatory approach to date has not yet met expectations. USAID should include a performance monitoring system in its agreements with the GOS which stresses that officials’ continued collaboration with projects will be based upon specific performance criteria which include the customer satisfaction surveys as recommended above.

9.2 Recommendation Concerning USAID/Senegal's Strategic Objective Approach

Conclusion/

Recommendation: USAID’s activities funded under the Mission’s old Strategic Object Two (SO2) and planned SO1 and SO2 need to be integrated to increase project impacts and sustainability.

The KAED and CBNRM approaches have relative operational strengths and weaknesses. Combined, each project’s (approach’s) strengths will minimize the other project’s weaknesses.

CBNRM's operational strengths include creating CR-level decision-making bodies and integrating CERP officials into project activities. The project's weaknesses include poor communication from the CR level to the grass-roots level; an abandonment of the participatory approach after the LUMP were produced; dubious technical information; and little sustainable financial support for village-level activities.

KAED's operational strength were in creating strong village-level organizations and activities; acceptable (though barely) technical information; and linking GIE to financial institutions. The project's weakness was that GOS officials were excluded from project activities; and benefits did not reach beyond the village level.

An assiduous "twinning" of a flagship CR-level project with a variety of village-centered projects would allow for the projects to complement each other. The following is a matrix which summarizes the linkages which could be made to achieve a sustainable food security promotion (NRM/IGA) system.

Group/ Institution	Rural Producers	CR- level Institutions	Local Government	Local Financial Institutions	National Level Policy Makers
Rural Producers		VBP	VBP	CRBP	CRBP
CR- level Institutions	VBP		CRBP	CRBP	CRBP

Local- GOS	VBP		C R B P	CRB P	CR BP
Local Financia l Institutio ns	CRB P	CRB P	C R B P		CR BP
National Level Policy Makers	CRB P	CRB P	C R B P	CRB P	

VBP - Village-Based Projects (such as KAED)

CRBP - CR Based Projects (CBNRM)

9.3 Recommendations Concerning Policy-Level Initiatives

The current policy environment which facilitates the creation of GIEs, recognized the legal status of entities such as the NRMCS, and reduced some of the more irrational components of the Forestry Code have made it easier for projects to promote sustainable participatory development activities. USAID should continue to engage the GOS in policy dialogue to promote a policy environment which allows for and promotes sustainable food security strategies at the rural producer. The three recommendations emerge from reviewing the policy environment in which projects work.

- Promote the legal standing of local language contracts
- Promote the status of local representative bodies (Sub-committee, federations) as GIEs
- Promote the creation of private sector service providers to support rural development activities.

Task Order No. 825
Contract No. PCE-1-00-96-00002-00

Annex H.

L'Analyse des Impacts Sociaux, Institutionnelle et Politiques

Préparé par
Amadou Hadji

Février 1999

Pour
l'USAID/Senegal

Hi

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
(EPIQ)

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1.0 L'Analyse Sociale

1.1 Le Contexte socio-économique

Les politiques sectorielles agricoles menées depuis 1960, expliquent les difficultés que connaît l'agriculture aggravées par une série de sécheresses. Les politiques de correction menées au début **des années 1980** dans le cadre des politiques de réajustement structurel ont été caractérisées par un désengagement de l'Etat et une tentative de responsabilisation des populations avec la Nouvelle Politique Agricole. Les mécanismes prévus n'ont pas correctement fonctionné car les populations n'ont pas été préparées au processus et les privés, qui étaient censés occuper le vide laissé par l'Etat, ont été remarquablement défaillants. Il s'ensuit des difficultés accrues de l'agriculture, nonobstant les efforts entrepris pour assainir la filière riz.

La décision prise par la plus haute autorité de l'état, de faire de l'agriculture une priorité, s'est traduite à partir **de 1996** par une injection de crédit pour l'acquisition d'engrais, de semences d'arachide, l'approvisionnement gratuit en phosphates naturels. Cela n'a pas eu d'incidences décisives sur les productions qui, dans l'ensemble on stagné ou baissé surtout dans les régions Nord, entraînant des déficits alimentaires, des baisses de revenus aux conséquences désastreuses sur la vie rurale. L'année **1997 / 1998** est significative à cet égard ; les récoltes particulièrement mauvaises de céréales, ont été durement ressenties par les populations durant la période de soudure. Quand au bétail, il a connu dans toutes les zones agricoles ou non agricoles une situation meilleure et a beaucoup contribué à atténuer le choc des mauvaises récoltes. Les revenus issus de la vente du petit bétail ont permis d'acheter des céréales et de subvenir tant bien que mal aux besoins des populations.

Face à cette situation, les stratégies de sortie de crise développées par les ménages sont assez diversifiées. Elles concernent l'exode rural, les migrations internationales, elles concernent les pratiques d'activités nouvelles telle que l'embouche le maraîchage, le petit commerce dans les marchés hebdomadaires. Elles concernent aussi l'exploitation des ressources forestières proches : charbon, bois de chauffe, racines, écorces, feuilles, fruits. Ces ressources sont exploitées de manière intensive et continue, ce qui compromet la régénération des formations concernées.

Dans le même ordre d'idées, on assiste à d'importants mouvements de populations, de bétail vers des zones plus favorables aux plans pluviométriques, sols. Ce mouvement concerne essentiellement les paysans, les troupeaux du pays sèches, du

Sine vers la zone sylvo-pastorale occidentale. Dans ces zones, la déforestation prend des proportions inquiétantes. De vastes superficies sont complètement défrichées et exposées au sol, au vent. Ce modèle de mise en valeur qui est celui du bassin arachidier, produit le même processus de dégradation sur des sols plus fragiles. L'élevage, dont la stratégie est fondée sur la mobilité, connaît aussi des difficultés liées à la rareté des pâturages, aux points d'eau, mares qui tarissent, forages en pannes fréquentes.

En effet, suite à l'accroissement du cheptel, qui s'est reconstitué après les grandes sécheresses, la pression sur la strate herbacée, sur les ligneux est de plus en plus forte. Ce processus a des conséquences négatives sur la situation des ressources naturelles aggravée par les années de sécheresse.

Au total on assiste à une spirale caractérisée par une dégradation des Ressources Naturelles (R.N), des difficultés dans les activités rurales, des pressions de plus en plus fortes sur les R.N. La lecture qu'on peut en faire du point de vue de la dynamique des espaces et des R.N. peut être résumée ainsi qu'il suit :

Dans les zones agricoles Nord et Centre ou ancien Bassin Arachidier, les activités agricoles sont confrontées à des difficultés structurelles aggravées par une pluviométrie incertaine. On y assiste à des départs massifs de la population active. Les jachères se développent au profit de l'élevage transhumant. L'agriculture devient extensive. De nombreuses couches de la population pratiquent des activités nouvelles telles que l'embouche, la transformation des céréales, le commerce dans les marchés. A cet égard des pôles économiques émergent en plus des marchés ruraux :

- L'axe Touba - Kébémér - Lompoul, axe commercial et de services centré sur les produits maraîchers, le poisson qui vont des Niayes vers Tamba et sur l'arachide le mil, les produits manufacturés qui vont de Touba vers les Niayes.
- L'axe Thiès - Diourbel - Touba qui en plus des flux ci-dessus développe l'embouche bovine, la transformation du mil.

Dans ces zones, on assiste à un recule de l'agriculture. Par contre, en raison de l'importance des établissements humains, les pressions pour le bois de chauffe, de service sont très fortes.

- Le Saloum consolide sa position de zone milicole arachidière mais est près

d'atteindre des limites, du fait d'un poids démographique en hausse continue. Les marchés hebdomadaires structurent un espace très dégradé : sols usés par une quasi absence de jachères, couvert végétal totalement détruit. Ces phénomènes sont aggravés par la mise en valeur des plateaux qui jouaient un rôle « d'éponge ».

- Les eaux ainsi libérées ravinent les sols. La situation des R.N. au Saloum est préoccupante.

Les cultures s'étendent vers le Ferlo avec les communautés religieuses, les populations sères rejetant les Peuls éleveurs plus en profondeur. Cette substitution de l'agriculture à l'élevage a des conséquences néfastes sur la situation des R.N.

Les régions périphériques au Nord (vallée du Fleuve), au Sud (Kolda - Tambacounda - Ziguinchor) du fait de conditions naturelles plus favorables accueillent des populations entraînant une déforestation continue des Ressources Naturelles. Les zones d'élevage se rétrécissent et la pression sur le R.N. est de plus en plus forte. Les impacts sociaux qui découlent de cette situation d'ensemble sont :

- Une certaine diversification des activités avec au plan RN des efforts positifs pour certains (embouche), des efforts négatifs pour d'autres (exploitation produits forestiers).
- l'expansion en général de la pauvreté
- D'importants mouvements de populations en direction des zones rurales plus en moins favorables, en direction des villes, Dakar Touba principalement

C'est dans ce contexte, que se situent les politiques de correction relativement récentes qui vont dans le sens de la décentralisation, de la responsabilisation des populations ; politiques qui se traduisent par un certain nombre de décisions, d'approches, de textes législatifs, réglementaires.

L'on est passé d'une période d'une grande intervention de l'Etat, à une période de désengagement de l'Etat, de responsabilisation des populations, de la promotion du secteur privé. Dans les politiques, cela s'est produit durant ces cinq dernières années

par de grandes décisions relatives à la décentralisation, presque partout ce sont des approches participatives qui sont développées. Les textes ont évolué avec quelques textes fondamentaux :

- La Loi 96 06, 96 07 sur la Régionalisation, le transfert de compétences aux collectivités locale;
- Le code forestier régissant les ressources forestières;
- La Loi sur les Sociétés Financières Décentralisées spécialisées dans le crédit à petite échelle;
- La Déclaration de Politique de Développement Agricole régissant l'agriculture au sens large.

Dans le cadre de ces politiques, il a été fortement affirmé une plus grande attention aux R.N et c'est dans ce contexte que se situent aussi les programmes de G.R.N développés par les populations avec des projets. Ces programmes visent à protéger, à régénérer la base de la ressource naturelle par des pratiques durables de G.R .N., ils y ont adjoind des activités génératrices de revenus.

1.2 Impacts sociaux des programmes

Il est encore tôt de mesurer les impacts sociaux des programmes, en raison de leur échelle pour certains, en raison de leur durée pour le quasi totalité. Cependant à travers la sensibilisation, le formation, ces programmes ont soulevé chez les populations locales et extérieures des attentes fortes qui se sont traduites par une dynamique sociale aux conséquences déjà sensibles au plan interne des groupes, au plan inter-relations avec les groupes au sein des villages, aux plans du processus de démocratisation, de la place de la femme.

En effet des groupes forts se sont constitués en ont vu leur rôle renforcé selon le cas, il s'agit de groupements féminins, de groupements mixtes, d'Associations villageoise de Développement. Les programmes ont participé à leur structuration en y développant les activités en fonction de normes organisationnelles, de gestion financière. Ces groupes ont vu leur rôle s'étendre à l'ensemble de la vie sociale du village par l'intégration d'aspects sociaux, religieux, économiques.

Dans les zones de projet, on a pu constater que ces aspects sociaux ont été un ciment plus fort que ce que proposait le projet et qui se limitait aux pratiques de

G.R.N., à quelques activités génératrices de revenus. Le groupe est devenu un pôle d'activités, un pôle social, un pôle de la décision ; il entretient des relations faciles ou difficiles avec d'autres pôles selon les intérêts en jeu.

Les mécanismes de concertation développés pour le choix des dirigeants, pour la prise des décisions, pour la transparence dans la gestion financière expliquent en grande partie le bouillonnement d'idées en cours dans les villages - programmes. Les remises en cause qui n'épargnent aucune structure, le projet y compris ont lieu. Ils participent au processus de démocratisation, de bonne gouvernance. Du coup, la place de la femme se trouve - t-elle renforcée du fait de son poids économique, sa place dans le processus de décision. Cette dynamique sociale quoique réelle ne doit pas occulter des questions de fonds.

En effet dans les différents programmes qui concernent les femmes surtout organisées en groupements, les revenus issus des activités génératrices de revenus sont redistribués aux membres du groupement afin de leur permettre, à titre individuel, de s'adonner à une activité laissée à leur discrétion. Ces activités concernent le petit commerce, l'artisanat... En retour, les retombées de cette activité individuelle servent à améliorer le menu quotidien, à satisfaire les sollicitations sociales (mariage, baptême, décès...), renforcées par l'appartenance au groupement.

Progressivement des besoins se développent et à la longue il risque d'y avoir une attente en revenus que le groupement ne peut satisfaire compte tenu, de ses faibles moyens. A ce moment, il y a risque de démotivation, de relâchement avec toutes les conséquences sur le fonctionnement du groupement. Ce risque est d'autant plus grand si le groupement traverse une phase difficile : retrait du projet, gestion financière défectueuse, divisions. Ces risques font même planer sur le groupement des risques d'éclatement. Le groupement n'est pas étanche, les problèmes politiques locaux peuvent y avoir des conséquences et se traduire par une exaspération des éventuelles divisions internes.

Ces situations doivent être présentes à l'esprit de la structure de gestion du programme qui doit les prendre en charge afin de minimiser leurs impacts négatifs sur les programmes.

Il n'en demeure pas moins que le groupe constitue un centre de production, de services. Concernant ce dernier point, la contribution du groupe par ses activités à développer des services est remarquable. Ces services contribuent à alléger les travaux des femmes et à procurer des revenus aux groupements : moulin à mil,

arachide. Ils peuvent par ailleurs contribuer à réguler les prix et aussi à procurer des revenus : banque céréalière...

Il Demeure par ailleurs un point d'ancrage des activités de santé (case de santé, planification familiale), d'alphabétisation (classe d'alphabétisation, réseaux).

Plus directement les activités développées, ont des incidences sur les revenus des adopteurs (voir impacts économiques) et sur la vie sociale des ménages. Ce dernier aspect faute d'études sur les dépenses des ménages peuvent être appréciées aux plans de situation nutritionnelle, (voir impacts économiques), des dépenses sociales (scolarité, santé, cérémonies, habillement, équipement mobilier), de la situation de l'exode rurale (**à développer**).

2.0 L'Analyse institutionnelle

2.1 Les programmes :

Dans les programmes étudiés, il convient de retenir deux types de programmes : les programmes exécutés par les ONG et le PCGRN. Des ONG ont servi de réceptacle à la recherche collaborative entreprise par l'ISRA dans le cadre du projet NRBAR : il s'agit de Rodale, de Winrock. Une ONG a réalisé le programme entrepreneuriat rural (Africare / KAED).

En ce qui concerne les ONG Rodale, Winrock on retiendra qu'il s'agit des ONG généralement engagées dans le développement communautaire couvrant tous les aspects de la vie rurale notamment les aspects liés à l'amélioration de la production agricole, des services, avec un accent sur le promotion des femmes et la gestion durable des R.N. C'est d'ailleurs eu égard à ce dernier aspect qu'elles ont été éligibles, dans le programme NRBAR / ISRA. Leur organisation consiste à concevoir les activités avec les populations, à finaliser cette conception au niveau de leurs bureaux à Thiès, à Dakar, à réaliser les activités sur le terrain avec les populations, les agents de terrain qui viennent du siège selon leur spécialisation, le facilitateur local ou le paysan-leader. Le suivi est conjointement assuré par les agents de terrain, les facilitateurs. La coordination se fait au niveau du siège avec le coordonnateur de l'ONG.

Eu égard à la gestion décentralisée, au sein des villages à encadrer, il n'y a pas trop de problèmes à suivre les programmes.

En ce qui concerne **KAED**, il s'agit d'une ONG avec les mêmes orientations que celles ci-dessus mais appuyée plus spécifiquement par l'USAID à promouvoir l'entrepreneuriat rural dans les régions de Kaolack.

Ses échelles d'interventions se présentent ainsi :

La représentation à Dakar était le contact avec le projet, les services étatiques, l'USAID. Une antenne à Kaolack assurait l'exécution des projets en travaillant étroitement avec les agents de terrain équipés de mobylettes chargés d'une zone, les populations. A propos des activités de planification, d'exécution des projets, il n'y a pas trop de problèmes.

Quant au PCGRN il s'agit d'un projet ayant une structure différente. Un Directeur sénégalais, un gestionnaire américain, des divisions spécialisées : Aménagement des Terroirs, Formation, Communication, Suivi Evaluation, Finances.

L'USAID a signé un accord de supervision avec SECID. L'ensemble du personnel administratif de conception, du personnel technique à Dakar forme l'unité de gestion du projet (U.G.P) qui assure le travail de conception d'ensemble, de coordination. Le travail de planification et d'exécution sont théoriquement du ressort, dans les Communautés Rurales des CERP, du comité de gestion, de l'Animateur en relation avec l'UCP. Il est évident que les relations entre les différentes échelles du projet peuvent être rendues difficiles par :

- La dispersion des CR sur l'ensemble du territoire et leur nombre important
- Le personnel limité en nombre auprès de la direction
- Le profil des agents inadaptés par rapport au rôle qu'on veut les faire jouer (ex : CERP, Animateurs)

Par ailleurs les termes de références limitent les activités du projet aux RN ; dans la continuation de la formule du Co-investissement du PRS . Cette orientation décale avec les attentes des populations qui en plus des RN veulent aussi des activités productives pouvant directement améliorer leur quotidien et cette orientation ne leur est pas clairement spécifiée. Au total, des ambiguïtés au plan de l'orientation du projet, des difficultés dans le travail de planification, de coordination caractérisent ce projet. Néanmoins il est en train de chercher un modèle pour dépasser le niveau village et atteindre le niveau Communauté Rurale (Approches sous-projets) alors que les autres projets sont au niveau village.

2.2 L'Emergence de nouvelles institutions agraires en milieu rural

L'Emergence de nouvelles institutions agraires en milieu rural à côté de certaines institutions traditionnelles est une réalité dans les sociétés rurales sénégalaises. Il s'agit :

- d'institutions politiques comme le Conseil Rural ;
- d'institutions sociales économiques comme les GIE, les G.P.F., les APE, les comités ;

- d'institutions techniques relais comme les GER, les animateurs, Le facilitateurs des projets.

Ces institutions dans leur philosophie, leur démarche visent selon leur niveau de compétences à participer au développement local. Dans ce contexte quelques unes retiennent notre attention.

2.2.1 Le Conseil Rural :

Il a été créé dans le cadre de la loi créant les Communautés Rurales. Il est le dernier maillon du processus de décentralisation. Le conseil Rural est l'organe délibérateur de la Communauté Rurale. Il se réunit à chaque fois que besoin mais au minimum deux (02) ou trois (03) fois dans l'année. Les membres sont élus au suffrage universel. Un bureau avec à la tête un président élu par les membres comprend entre autre des commissions spécialisées dont une commission RN.

Il est compétent dans neuf (9) domaines ainsi que le précise la loi portant transfert des compétences (96 - 07) :

- Aménagement du Territoire
- Planification
- Education
- Santé
- Jeunesse et sport
- Culture
- Ressources Naturelles
- Foncier

Du fait d'une plus grande pratique de la politique foncière pour laquelle il a été formé et pour laquelle il a eu à légiférer pendant plusieurs années le conseil rural maîtrise les problèmes liés à l'application de la loi sur le Domaine National. Par contre pour les autres domaines, objet de transfert récent, notamment les R.N., il a moins d'expertise. Cette remarque est à relativiser car dans les régions sud où les Ressources Naturelles constituent un enjeu, les Conseils Ruraux sont au courant des dispositions du texte principal régissant les ressources forestières, le code forestier. Ils y sont attentifs mais ne prennent pas encore de décisions importantes. En plus certaines nuances juridiques leur échappent.

Comme toute instance politique, les Conseils Ruraux sont confrontés à de nombreuses contraintes d'abord le problème de la représentation. En fait ne sont représentés dans le Conseil Rural que les leaders des villages importants cela a son importance dans les réalisations qui sont souvent localisées dans ces villages. Le conseil rural par ailleurs reflète les luttes politiques acharnées qui peuvent aller jusqu'à entraîner des blocages. Il peut dans ses décisions subir les pressions des autres niveaux politiques ou du pouvoir économique et religieux. Ces interférences des autres niveaux de décision peuvent atténuer son efficacité. Par ailleurs ses moyens qui viennent essentiellement de la taxe rurale, des droits de marché, du fonds de dotation sont très limités et réduisent ses interventions en termes d'investissements.

2.2.2 Les institutions d'exécution, de concertation.

Elles sont assez diversifiées eu égard à leurs fonctions locales, leurs objectifs.

2.2.2.1 *Le G.I.E :*

Il est issu d'une loi créant les GIE. Les formalités étant difficiles pour créer une Société, le GIE constitue un raccourci dans la création d'entreprise. Il suffit d'être au moins deux membres, d'avoir un registre de Commerce, d'être enregistré au niveau du services des domaines. De nombreuses associations, groupements ont emprunté cette voie de reconnaissance exigée par les banques les projets pour être éligibles aux financements. Cette condition montre le niveau d'attente soulevé par l'existence d'un G.I.E. travaillant avec un projet ou dans la perspective de travailler avec un projet. Le GIE comporte un bureau et des commissions. Dans les faits ce sont les membres du bureau qui sont les intermédiaires entre les GIE et l'extérieur.

Au plan interne, des réunions sont régulièrement organisées. Les GIE, particulièrement, les GIE de femmes, mènent de nombreuses activités et bénéficient de financement de la CNCA ou des structures financières décentralisées. Dans le cas de la présente consultation KAED, Rodale ont travaillé avec des GIE de femmes.

Dans les GIE de KAED, le nombre varie de 50 à plus de 100 membres et certains sont mixtes. Chaque GIE possède un champs de démonstration d'un ha qui est une unité de production d'arachides, de mil, sur laquelle sont testées les pratiques de GRN : Haies vives, brise vent, arbres dans les champs, compost, cordons de pierres...

Le GIE possède par ailleurs dans le cadre des activités génératrices de revenus un moulin à mil, une pépinière, une Banque céréalière, un périmètre maraîcher, une ferme d'embouche. Dans l'unité économique génératrice de revenu le travail est organisé de manière à ce que tous les membres valides du groupement participent selon un planning interne du travail.

Les revenus générés, après déduction des charges de fonctionnement, après paiement du crédit, sont distribués aux membres du groupement afin qu'elles puissent mener leurs propres activités (Crédit revolving). Ces activités et leurs retombés comblent les attentes chez ces femmes du Saloum peu ouvertes au monde extérieur. Elles développent ainsi des mécanismes sociaux qui dépassent largement le cadre des activités : les cérémonies familiales (Baptême, mariage, décès) sont marquées par la forte présence des membres du groupement et leur appui financier matériel. Un équipement approprié, propriétaire du groupement, est acheté pour ces occasions (Bancs, ustensiles de cuisine).

Par le biais du GIE, les femmes bénéficient de programmes d'alphabétisation, de titres d'affectation de parcelles délivrés par le CR. Elles sont en réunion, en contact avec des personnes extérieures ; cela donne à la femme un statut tout à fait nouveau par rapport à son statut traditionnel. Ce statut est renforcé par son nouveau pouvoir économique acquis dans le cadre du groupement.

Ses rapports avec les hommes changent. Le groupement devient un centre décision plus ou moins accepté par les autres centres de décision. Du fait du rôle économique du groupement dans les ménages, les détenteurs de pouvoir se taisent mais ne manquent jamais l'occasion de faire sentir leur pouvoir à la présidente du groupement surtout.

Tant que le projet a fonctionné et que le niveau d'attente était élevé, les femmes ont fait bloc au sein du GIE mais avec la disparition du projet, des fissures ont commencé à se manifester : absentéisme, remise en cause de la présidente, des activités.

Dans le programme Rodale le projet travaille avec les GIE aussi mais avec un encadrement moins rapproché la dynamique sociale enclenchée est la même avec peut être moins d'ampleur compte tenu des niveaux de réalisations différents.

2.2.2.2 Le comité de Gestion du P.C.G.R.N.

A la mise en place du projet, le conseil Rural n'était pas habilité à gérer un compte bancaire selon le principe de l'unicité de caisse en vigueur dans l'administration sénégalaise. Par ailleurs, des couches sociales ayant un rôle important tels les jeunes, les femmes ne sont pas représentés es qualité au sein du Conseil Rural. Pour ces raisons, il a été décidé de mettre en place un comité de gestion des R.N. Les membres du comité sont choisis par les populations de l'ensemble de la Communauté avec une représentation du conseil rural des Femmes, des jeunes, des groupements socioprofessionnels. Le comité est placé sous la tutelle du Conseil Rural et il constitue la structure exécutive du projet dans la communauté Rurale ; il comporte quatre organes :

- un bureau exécutif
- une commission de sensibilisation, animation, vulgarisation (SAV)
- une commission de gestion des R.N
- une commission des comptes.

Les fonds qui sont une subvention du projet sont gérés par le bureau exécutif, le comité tient tous les mois une réunion pour passer en revue les activités en cours ou prévus.

Les membres du comité de gestion ont bénéficié de nombreux programmes de formation, de visites au Sénégal et à l'extérieur. Cela les a beaucoup aidés dans leur travail d'appui technique organisationnel, de suivi. Cela a réajusté sur la gestion de leur propre activité, sur la gestion du Conseil Rural, du groupement contribuant ainsi au renforcement du processus démocratique, de la bonne gouvernance. En retour, ce changement de mentalité a fait que les membres du comité sont très critiques sur le fonctionnement du projet : retard dans les actions prévues, faible échelle de réalisations, non prise en compte des activités génératrices de revenus.

L'on en arrive à une situation de semi blocage entre le comité et le projet, entre le comité et les populations locales et à un processus de démotivation, de relâchement préjudiciable au projet. Dans ces conditions l'après projet n'est pas garanti. Des corrections sont menées avec l'approche sous projets actuellement développée.

2.2.2.3 L'Association des Parents d'Elèves, l'Association traditionnelle

Dans les programmes Winrock, une nouvelle structure n'a pas été créée. Dans certains villages, l'Association des parents d'élèves dont les membres sont bénéficiaires du programme est la structure relais entre le projet et les populations ; dans d'autres où il n'y a pas eu de parrainage d'élèves, c'est l'Association traditionnelle du village qui a servi de structure d'accueil du projet.

Dans les deux cas leurs relations avec le projet sont moins formelles et le rôle du facilitateur issu du village est déterminant. Cette formule présente de nombreux avantages car les structures relais très liées à la vie du village ont l'avantage d'être pérennes. Cela s'est vérifié à Ndolor. Cette pérennisation est accrue par le fait que les pratiques vulgarisées à savoir les semences améliorées, le compost, le manioc sont très appréciées des populations. Elles s'en sont appropriées et elles développent des mécanismes intéressants tels que la production, la vente de semences sélectionnées par les paysans eux-mêmes.

2.2.2.4 Les structures - Relais

Il s'agit des structures d'appui technique intermédiaires entre le projet et les structures d'exécution, de concertation, les populations. Selon le cas il y a le CERP dans les zones PCGRN, les facilitateurs dans les zones Winrock, les agents de terrains dans les zones KAED et Rodale.

Dans les zones PCGRN: les mécanismes de relais sont plus complexes eu égard à l'échelle d'intervention qu'est la communauté rurale. Très tôt, le projet a eu conscience que la dispersion des actions dans le cadre des micro-réalisations n'avait aucun impact significatif au plan physique. Par ailleurs cette approche ne favorisait pas une réelle participation des populations dans la conception des programmes, à leur appropriation. C'est compte tenu de ce constat que l'approche sous-projet fut mise en oeuvre avec un objectif double, à savoir la concentration des réalisations sur un espace permettant d'obtenir un impact physique, l'implication réelle des populations par « l'effet de proximité ». Un sous-projet plusieurs villages avec dans chaque village un représentant du projet choisis par ses pairs parmi les paysans. Une concertation au sein de la zone devrait permettre de prendre en charge tous les aspects du projet : conception participative, exécution, suivi. Par la même occasion, les aspects liés aux contraintes à la coordination, à l'intermédiation devraient être traités localement. Ceci schéma n'a pas correctement fonctionné dans les communautés rurales de première génération. Car si le niveau d'information est généralement bon pour les dirigeants, il est très faible pour le reste de la population. Par ailleurs, au plan de la décision des activités à entreprendre, il est vérifié que la décision est prise ailleurs et les bénéficiaires ne sont informés que par la suite sans d'ailleurs qu'il y ait continuité dans l'information (approche Top Down, approche goutte - à- goutte).

Dans les Zones KAED : l'encadrement est plus rapproché, on peut y distinguer différents niveaux :

- Les agents du bureau de Kaolack (agro-économiste, spécialistes en formation, en ressources naturelles, en genre...) qui assurent la coordination, la supervision sur le terrain selon leurs compétences.
- Les agents des zones basés à proximité des villages qui assurent le suivi des activités dans un certain nombre de villages. Ils sont polyvalents et servent de relais aux agents du bureau.
- Dans les villages, les responsables des groupements servent de relais entre les agents du bureau, les agents de terrain et les populations.

Dans les zones WINROCK: les agents du bureau aux profils divers assurent directement le suivi des actions sur le terrain avec comme relais, un facilitateur choisis par les paysans.

Dans les zones RODALE : Ce sont les responsables du groupement qui servent de relais aux agents du projet dans le cadre du suivi des activités. Il y'a lieu de noter qu'à Ndof, compte tenu du relatif isolement du village, un facilitateur issu du milieu a été choisi comme relais.

Les profils des agents sont très diversifiés. Dans les CERP ce sont les membres de l'équipe constitués d'un Chef de CERP (Ingénieur des Travaux de Planification) d'un agent des Eaux et Forêts, d'agriculture, d'élevage, d'une monitrice rurale. Ces agents en plus des tâches traditionnelles (vaccination bétail, recensement agricole ...) sont chargées de l'appui technique aux populations.

Ils n'ont ni le temps, ni l'expertise technique, ni les moyens matériel suffisants. Il bénéficie d'un véhicule et d'une dotation de carburant fourni par le projet cependant compte tenu de l'ampleur des tâches cela s'avère nettement insuffisant.

Au total une grande diversité de situations dans les projets ; l'on retiendra :

- Les bons résultats obtenus par les GIE, des ONG les différentes associations aussi bien qu'au plan des pratiques de GRN que d'activité génératrice de revenus.
- Les bons résultats obtenus par le Comité de gestion au plan de la sensibilisation de l'élite et les résultats mitigés au plan des réalisations physiques, de l'information des populations.
- L'absence de maîtrise technique au niveau des CERP, de l'animateur communautaire pour les tâches qui leur sont dévolues (PCGRN)
- La grande maîtrise technique des agents de terrain (Africare, Winrock, Rodale).le recours prometteur à des facilitateurs locaux (WINROCK, RODALE) assurant la pérennisation des programmes.

Par rapport au processus de décentralisation qui transfère les Ressources Naturelles, la planification et d'autres compétences aux Conseil Rural il y a lieu de se demander quels rapports ces projets entretiennent-ils avec le Conseil Rural ? Cette question est importante dans le sens de l'appropriation des projets par les populations, dans le sens de leur pérennisation. Le P.C.G.R.N. fait beaucoup d'efforts dans se sens. Le

comité de gestion est placé sous la tutelle du Conseil Rural qui par ailleurs est représenté dans le Comité de gestion . Le rapport mensuel du comité lui est régulièrement envoyé. L'implication du C.E.RP. est un autre mécanisme de pérennisation.

Quant aux autres projets il n'y a presque pas de relations avec le Conseil Rural, sinon que de temps à autre le Conseil est sollicité pour délivrer des actes d'affectations de terres aux promoteurs. Les relations avec le C.E.RP. sont inexistantes. Les mécanismes de relais développés seront-ils pérennes ? Oui dans le cas du facilitateur de Winrock, non dans le cas d'Africare, Rodale on nuancera cette remarque par l'existence de G.I.E, d'activités diverses. L'on peut penser que les activités génératrices de revenus pourront survivre au projet si elles continuent à avoir les fonctions décrites plus haut et si le niveau de revenus s'améliore. Dans ces conditions, l'intérêt jouera avec ou sans projet.

En ce qui concerne le Conseil Rural, il y a lieu de penser qu'à l'avenir, il sera attentif à tous ces programmes, compte tenu des compétences qui lui sont transférées par l'Etat. Il est dans l'expectative pour le moment par manque de connaissances des textes mais avec le temps cette lacune pourra être comblée et on n'ose espérer qu'il aille vers les projets.

Cette situation d'ensemble est peu luisante quant à la capacité des différentes institutions à promouvoir une gestion durable de Ressources Naturelles. La question de l'orientation des projets, les difficultés inhérentes aux pratiques de GRN (cf Pratiques) font que la mise en oeuvre des pratiques de démonstration est confrontée à des contraintes réelles au niveau des adopteurs, des institutions en place. Le temps que cela prend pour résoudre ces contraintes ne permet pas de prendre en charge l'effet tâche d'huile escompté.

La résolution est d'autant plus retardée que la pertinence des pratiques développées pose problème. Là, il y a lieu de s'appesantir sur les pratiques développées par Winnock (Semences sélectionnées, compost, manioc). Leur pertinence est telle qu'on n'a pas eu besoin de beaucoup d'effort pour les faire passer. De même les résultats obtenus par le P.R.S dans les Niayes (Ndene CR Notto Gouye Diama) sans relais se passent de commentaires et l'opération continue toujours en raison de l'intérêt qu'on lui porte, en raison de la perception qu'on a l'importance de la fixation des dunes (Protection des cuvettes de cultures et des habitations). Ainsi il y a lieu de réfléchir sûrement sur les Institutions mais il y a lieu d'accorder une attention particulière à la pratique qui doit servir de porte d'entrée. Ceci pour dire que les

orientations priment sur les Institutions ou qu'il y a une équilibre à maintenir entre les orientations en termes de pratiques pertinentes et les Institutions.

3.0 Les impacts des Programmes sur les politiques

Les différents programmes de GRN à travers le diagnostic sur la situation des R.N., les pratiques développées, les institutions mises en place, la démarche participative généralisée ont beaucoup impulsé le processus de décentralisation et les différentes autres politiques de développement rural.

3.1 Sur la Décentralisation

Le processus de décentralisation a été amorcé depuis 1972 : loi créant les Communautés Rurales, Les Conseils Ruraux, loi sur le Domaine National. Plus récemment un pas important a été franchi avec le transfert de neuf (9) compétences aux collectivités locales : Régions, Municipalités, Communautés Rurales : loi NE 9606 sur la régionalisation, loi 9607 sur le transfert des compétences. Cet ensemble de textes législatifs ainsi que les décrets d'application sont au niveau des grands principes de l'amélioration du cadre juridique pour la mise en oeuvre de la décentralisation. Confrontés à la réalité au moment de leur application en situation, il y a lieu reconnaître qu'il y a toute une instrumentation à concevoir et de ce point de vue les différents programmes de G.R.N. ont beaucoup contribué à cela. Les aspects liés aux formes d'organisations, à la planification, aux actions pertinentes, prioritaires au financement aux préalables institutionnels, réglementaires ont été développés compte tenu des réalités combien complexes des sociétés rurales. Ce fut presque de l'expérimentation puisqu'aucun modèle n'a été conçu jusqu'à là.

Ainsi la méthodologie d'intervention au sein de laquelle l'approche participative a été développée est-elle progressivement améliorée. Elle trouve dans la politique de décentralisation un cadre approprié qui permet de faire le pont entre les collectivités locales et les populations, qui permet d'établir des relations organiques entre l'échelle politique et l'échelle d'exécution. Des institutions se mettent en place et constituent des cadres de concertation ; des structures relais fonctionnent et tentent l'intermédiation entre les projets, les collectivités et les populations. Des mécanismes de planification participatives sont conçus et permettent de tenir compte des préoccupations des populations, de la demande de la clientèle. Des programmes multi sectoriels sont proposés.

Cet ensemble d'actions constitue ce qu'on peut appeler l'instrumentation de la Décentralisation c'est à dire la conception d'outils permettant de passer de l'état de concept à l'état de réalité. La Communauté des bailleurs, l'USAID notamment s'est

beaucoup investie dans ce domaine de l'instrumentation. L'approche PCGRN constitue un cas intéressant.

3.2 Démocratie - Bonne Gouvernance

Il y a lieu de souligner que la mise en pratique de cette instrumentation a généré de nouveaux comportements. Il s'agit d'une plus grande ouverture des populations vers d'autres réalités que celles de leurs terroirs, il s'agit du recours au jeu démocratique dans la mise en place des institutions, dans le choix des hommes et des femmes pour les postes de responsabilité, il s'agit d'une gestion des finances et des biens de plus en plus transparente par rapport à un passé récent. La place de la femme s'est considérablement améliorée dans ce contexte et les hommes progressivement acceptent cette nouvelle situation de la femme. Ces changements de comportements vont dans le sens du renforcement de démocratie, de la bonne gouvernance. Et la Communauté des bailleurs y a beaucoup contribué.

3.3 Les Nouvelles Politiques

Dans le même ordre d'idées cette même communauté dans le cadre de ses relations avec le gouvernement du Sénégal a encouragé de nouvelles politiques (NPA, LPDA) avec un accent sur une plus grande responsabilisation des populations dans la production, les services, une tendance à y supprimer les subventions. Le secteur privé est appelé à jouer un grand rôle.

3.4 Le Crédit

C'est dans ce contexte de suppression des structures de financement étatiques que sont développées les structures de financement décentralisés plus adaptés à la demande des populations afin de résoudre le problème du financement à la base

De même l'expérience tentée par Africare dans le Projet KAED financé par l'USAID est intéressante pour résoudre ce problème du financement. Il s'agit d'un fonds de garantie déposé auprès de la CNCAS et qui a permis aux différents promoteurs KAED de bénéficier facilement de crédit pour les activités génératrices de revenus. Bien que le programme a pris fin, les groupements continuent toujours

de bénéficier du crédit de la CNCAS et les remboursements s'effectuent régulièrement.

3.5 Code Forestier, LDN, PNAE

La législation en cours, dans bien des cas constituait un frein aux développements d'activités productives. Ainsi, le problème était - il posé avec le P.R.S. Les promoteurs qui avaient planté des arbres avec l'appui de ce projet n'avaient pas la possibilité de les exploiter car les textes en vigueur notamment l'ancien Code Forestier ne le permettaient pas. Le P.R.S., un projet financé par l'USAID a travaillé afin d'obtenir de la partie Sénégalaise une législation plus adaptée. C'est dans ce contexte que fut élaboré le nouveau Code forestier qui autorise tout promoteur d'exploiter sans entraves les ressources forestières qu'ils auraient mises en place, avec bien sûr l'autorisation des Services forestiers.

Avec la monétarisation de l'économie, la terre eut une valeur marchande ; les grands propriétaires traditionnels les distribuèrent chaque année aux paysans moyennant une redevance en nature ou en espèce. Cette redevance, sans être lourde, était quand même pesante surtout au plan de la stabilité foncière. Afin de protéger les paysans contre toute spéculation foncière, la Loi sur le Domaine National fut adoptée 1972. Depuis 1981, avec le désengagement de l'Etat, le Sénégal est entrain de passer d'une économie étatique à une économie libérale. L'on encourage les investissements privés de toutes sortes qui ne peuvent être réalisés sans une certaine sécurisation foncière. Par ailleurs, le crédit devient incontournable d'où la nécessité de présenter des garanties réelles notamment des garanties foncières. C'est dans ce contexte, que les bailleurs se concertent avec les autorités Sénégalaise en vue d'une réforme foncière. Des perspectives de compromis semblent se dessiner concernant aussi bien la sécurisation des investisseurs que la sécurisation du petit paysan, avec la possibilité de délivrer des titres aux premiers.

Dans un contexte caractérisé par de nombreuses remises en cause, un cadre d'intervention était une nécessité. Avec l'élaboration du Plan National d'Action pour l'Environnement (P.N.A.E.), la Communauté des bailleurs, l'USAID notamment a aidé à la mise en place de manière concertée, ce cadre avec le Consere dans le même ordre d'idée, elle a aidé à définir le Plan d'Action National de Lutte contre la Désertification.

4.0 Les nouvelles politiques, l'environnement qu'elles ont créés, les projets face à cet environnement et quelques recommandations

Face aux déficits chroniques des finances de l'Etat, en relation avec le soutien apporté à des Sociétés Publiques régulièrement confrontées à des problèmes de gestion, le Sénégal a entrepris à la fin des années soixante dix avec les autorités monétaires de Breton wood, FMI et Banque Mondiale, un programme d'ajustement structurel. Au plan de la politique de développement rural, cela s'est traduit par un désengagement de l'Etat des structures de production, des structures marchandes, la responsabilisation des producteurs dans le cadre de la NPA (1980-1985)

L'ONCAD (Office National de Commercialisation Agricole et de Développement), l'organisme central pour la commercialisation des produits agricoles, l'approvisionnement en semences, engrais, matériel agricole a été dissout avec un passif de 100 milliards de FCFA. La B.N.D.S (Banque Nationale de Développement), pivot financier du crédit agricole a elle aussi été dissoute dans le cadre de l'assainissement des structures financières. Du coup, les Sociétés Régionales qui étaient un élément régional du dispositif d'appui ont senti le coup et ont fini par disparaître ; il s'agit essentiellement de la SODEVA dans le bassin arachidier, de la SOMIVAC en Casamance. Celles qui sont restées ont vu leur mission restreinte par des lettres de mission à des activités bien limitées avec des objectifs de production précis. C'est le cas de la SAED, dans les aménagements hydroagricoles dans la Région de Saint Louis, de la Sodefitex dans le coton, l'élevage dans les régions de Tambacounda, de Kolda. Actuellement dans le bassin arachidier, la SONACOS Sonagraines. A la charge de l'arachide avec en aval le crédit pour les semences, les engrais, la reconstitution du capital semencier et en amont la commercialisation, la trituration, l'exploitation de produits arachidières. Elle est en voie de privatisation.

La fonction de vulgarisation est totalement absente dans les zones où il n'y a plus de sociétés régionales de développement. Le P.N.V.A fut éphémère .

Les C.E.R.P partout présents, se sont, dans bien des cas sidéroses faute de moyens pour remplir leur mission.

La CNCAS sensé couvrir l'ensemble du territoire national en ce qui concerne le crédit, n'a pas les moyens suffisants pour sa politique et de plus elle est inaccessible au petit paysan.

Les S.F.D . se développent, mais elles ne peuvent satisfaire qu'une partie la demande dans les zones où elles sont implantées ; les zones sans S.F.D sont laissées pour compte et elles sont très nombreuses à être dans ce cas.

Cette situation d'ensemble du désengagement de l'Etat sans préparation et sans l'émergence d'un secteur privé de substitution a plusieurs conséquences. Les fonctions d'approvisionnement en intrants, d'appui techniques aux producteurs, de commercialisation sont dans de nombreux cas inexistantes. Au plan social, à cause des nombreuses pertes d'emplois suite à la dissolution des sociétés étatiques, à la privatisation des structures de production, de services et les mécanismes d'assainissement qui ont suivi, la situation de l'emploi est très difficile. Dans le même ordre d'idées, le dégraissage de la fonction publique par des départs volontaires, par le gel de recrutement dans la fonction publique combiné aux difficultés de l'agriculture se traduit par une demande sociale de plus en plus forte, par une pauvreté accrue de couches importantes de la population (**cf. Etude Banque Mondiale sur Pauvreté**).

Eu égard aux liens très importants unissant les villes et les campagnes, il y a lieu de noter que cette situation de l'emploi préoccupante dans les villes se ressentira dans les campagnes et aggravera le situation déjà difficile des campagnes les agents de l'Etat qui restent sont en nombre limité et faute de moyens matériels ils sont souvent inopératoires .

A quelque chose malheur est bon car, on note en nombre chez les producteurs, face à ces difficultés, des changements de comportement, porteurs de progrès si on sait les utiliser à bon escient. Une diversification des activités se développe aussi bien en ville qu'en campagne. On assiste à la mise en valeur de vallées pour faire du maraîchage, à un développement de la transformation, la commercialisation des produits agricoles, à une intensification des activités d'élevage, à une offre de service de toutes sortes (**voir chapitre 1, l'analyse sociale**) .

Dans le domaine de l'éducation, de la santé, de l'eau les populations organisées en associations en comités de gestion, prennent en charge des dépenses jusque là faite par l'état et ce malgré les difficultés.

Une attitude nouvelle se développe face au crédit dont, on sait qu'il est incontournable, dont on est conscient qu'il faut le rembourser (taux de remboursement semences, engrais 90% dans le cœur du bassin arachidier en 1987, 1998).

Au total la situation du monde rural peut être ainsi résumée :

- une situation interne difficile que renforcent les difficultés urbaines;
- des réajustements en vue de s'adapter tant bien que mal face à cette situation;
- des changements de comportements porteurs d'espoirs.

Ces réajustements et changements contrebalancent en partie les difficultés sociales dont il est question plus haut ; ils participent à l'auto-promotion, à la prise de conscience d'une nouvelle réalité faite de compétition, de travail avec bien sûr des spécificités locales qu'il ne faille perdre de vue. C'est dans ce contexte que se meuvent les projets et il est intéressant d'essayer de comprendre leur fonctionnement, les difficultés qu'ils rencontrent à la lecture de cette situation dominée par la lutte pour la survie du côté des populations.

4.1 Le Cas KAED

Ce programme a tenté de répondre aux attentes des populations telles qu'elles découlent de la situation ainsi décrite. Les actions proposées touchent la gamme des activités généralement retenues comme réponse à la difficile situation. Il s'agit du champs de démonstration qui est une unité de production du type champs commun, du périmètre maraîcher, de l'unité d'embouche, de la banque céréalière, du moulin à mil.

La pertinence du choix par rapport aux conditions du milieu, le montage technique ont posé problèmes et les populations de manière spontanée ont apporté des correctifs en essayant de les adapter à leurs préoccupations. En appui à ces activités un intéressant programme de crédit a été développé : dépôt d'un fond de garantie où la CNCA et possibilité pour les groupements d'y accéder. Ce programme continue et fait école le programme d'alphabétisation développé va dans le même sens.

Les modalités de vulgarisation n'ont pas été pérennes (voir analyse institutionnelle) .Le programme de GRN n'a pas donné les résultats escomptés en égard à la place prépondérante accordée à l'entrepreneuriat rural, à la pertinence des actions proposées dans ce domaine.

4.2 Le Cas du PROGES

La porte d'entrée retenue fut suffisamment mobilisatrice (voir note sur PROGES). Cependant, l'ONG n'a pu servir de relais permettant de mettre en valeur les vallées. Ce relais devrait s'atteler à régler les problèmes d'appui technique de toutes sortes d'approvisionnement en semences, en engrais par une politique adaptée de crédit, ce qui ne fut pas le cas.

4.3 Le Cas du PCGRN

Ce projet sauf quelques rares cas (ex : PAKANE) n'a pas su répondre aux attentes du moment du fait de son orientation, de la faiblesse des réalisations retenues ou en cours. Par ailleurs, les CER sur lesquels, il s'appuyait n'ont pas donné les résultats escomptés. Ainsi, les projets se meuvent dans une situation caractérisée par des attentes très fortes des populations eu égard aux conditions de l'agriculture difficile, à un esprit de dépendance aux projets présents ou dont on entend parler caractérisé aussi par un désengagement de l'état avec à la clef des services de vulgarisation défaillants, des structures d'approvisionnements en semences, en matériel agricole quasi inexistante dans de nombreuses zones. Le montage des projets doit tenir compte de cette situation au risque que les projets soient toujours confrontés aux problèmes liés à ces manques, et qui ne se ressentent amèrement dans les actions en cours.

4.4 Recommandations Provisoires

Compte tenu de cette situation complexe aux plans des attentes des populations, de leur stratégie de survie, du déficit en structures de vulgarisation d'approvisionnement intrant, en rapport avec le montage des projets décalés par rapport à cette réalité il ya lieu de retenir quelques axes de réflexions, d'interventions pouvant éclairer des projets financé, par l'USAID.

Des actions intéressantes ont actuellement lieu dans toutes les régions du Sénégal en fonction des spécificités locales ; elles constituent des réponses pertinentes aux problèmes vécus par les populations donc à leurs attentes. Ces actions peuvent constituer le point de départ, d'ancrage d'autres actions en vue de les améliorer, en vue d'y intégrer d'autres notamment celles qui concernent les RN , ex : maraîchage- puits- reboisement- embouche - compost, semences – compost, semences – régénération du couvert végétal, micro barrages - reboisement.

Cet encrage se situe au niveau des négociations qui sous tendent la planification concertée des actions. Cette phase sera l'occasion de maîtriser les activités en cours, les aspects positifs, les contraintes de négocier les activités à y adjoindre, les modalités de cette jonction (localisation, coûts, formes d'organisations, part du projet, part des populations). Un des moyens de renforcer ces activités et de développer dans le même contexte des activités de services : ventes d'intrants, moulins à mil, banques céréaliers.

La démarche participative est incontournable. Cependant certaines de ces composantes méritent une attention particulière car elles constituent les points faible, de nombreux projets :

- Un relais local choisi par les populations peut beaucoup aider dans les relations entre le projet et les populations, il peut par ailleurs continuer le travail à la fin du projet.
- Une structure de concertation locale du type sous comité, GIE est un passage obligé dans le cadre de la décentralisation de la concertation. Plusieurs structures locales peuvent se fédérer en fonction d'intérêts qui les lient.
- Afin d'informer les membres du programme à quelque échelle qu'ils se trouvent, un système doit être développé avec des modalités appropriés sur les questions qui concernent les membres.

L'appui technique est un autre maillon faible des projets aussi des modalités d'un appui technique approprié est un impératif. L'appui aux projets de structures spécialisées, proches peu être envisagé. A titre d'exemple, il ya d'explorer des possibilités d'exploration au plan technique entre le PCGRN, le corps Américain de la Paix, Winrock ;

Les moyens financiers pour appuyer un approvisionnement en intrants, en matériels pour financer les projets de manière générale font défaut. Les conditions d'accessibilité aux moyens financiers excluent de nombreuses couches de la population, la garantie surtout. L'expérience Africare dans le domaine du Crédit, fonds de garantie par un projet est intéressant en égard à la solution du problème du crédit. Dans le même ordre d'idées, les actions des SFD devront être explorées.

La part du privée dans les programmes développés sur le terrain, est nulle. Il ya lieu de réfléchir sur les moyens de les impliquer en vue d'impulser un développement local. Le cas de BUD – SENEGAL, de la SOCAS sont intéressants à cet égard aussi bien en ce qui concerne l'appui technique, la commercialisation des produits dans le cadre d'une concertation entre les acteurs.

L'expérience a montré qu'il ya de nombreuses études dont la pertinence de certaines est à voir. Dans ce domaine, il ya lieu d'apporter des corrections en vue d'un nombre limité d'études, en vue d'études pertinentes en égard aux besoins des programmes

La formation notamment l'alphabétisation fonctionnelle, est un préalable.

5.0 L'Orientation du PCGRN

Il y a un certain nombre de points à éclaircir par rapport aux termes de références du projet, par rapport au contrat avec le SECID sur les buts, les objectifs du projet.

S'agit - t'il d'un projet avec comme dominante la confection d'un modèle d'intervention dans les Communautés Rurales, avec un accent sur la méthodologie, le comportement des populations. Où s'agit - il d'un projet avec des obligations de réalisations physiques aussi bien dans le domaine des RN que dans le domaine des activités génératrices de revenus ?

Les réponses à ces questions sont importantes car elles permettent de faire une évaluation objective par rapport à ce qui se fait actuellement. En effet, la priorité semble donnée aux changements des comportements des populations à travers un ensemble d'actions que reflètent les intrants ci-après :

- Etablissement de Cartes
- Etablissement de PAGT
- Formation de conseillers Ruraux en GRN
- Formation de Paysans
- Formation des agents des CERP
- Elaboration d'un modèle de suivi à moindre coût (Local, National)
- Renforcement des capacités des CR à collecter les taxes.

En ce qui concerne les réalisations physiques, il convient de noter qu'elles se limitent à un objectif de 400 projets à réaliser sur la base du Co-investissement. Il reste entendu que l'effet tâche d'huile escompté avec ces réalisations, le renforcement des capacités d'intermédiations en vue d'autres réalisations notamment celles concernant les activités génératrices de revenus permettront d'obtenir des résultats importants dans les zones couvertes par le projet. Ces deux axes d'orientations bien que complémentaires peuvent ne pas être compris dans un contexte où les attentes sont très fortes du côté des populations ; Les responsables du projet pensent que les termes de référence concernent le premier axe d'intervention ; les populations et bien d'autres personnes pensent que compte tenu de l'enveloppe financier du projet, les réalisations ne sauraient se limiter à quelques financements à des fins de démonstrations. Elles devraient être plus importantes et couvrir aussi bien les ressources naturelles que les activités génératrices de revenus. Il s'ensuit d'ailleurs

une évolution remarquable du projet dans le sens d'une conciliation des deux axes sans pour autant remettre en cause les termes de références.

En effet les premières réalisations ont été faites sur la base du Cofinancement ; eu égard à leur extrême dispersion, à leur faible impact, le projet opte pour l'approche sous-projet. Avec cette approche, un ensemble d'actions est prévu pour une zone, aussi bien des actions de GRN que des actions génératrices de revenus.

Ce paquet d'actions est destiné au groupement. Certaines sont réalisées en commun, d'autres au niveau des individus. Cette approche ne règle pas l'échelle des interventions qui demeurent toujours petite. Elle ne règle pas le niveau des attentes des populations toujours fortes. Face à cette situation, le projet cherche à avoir recours à d'autres partenaires afin qu'ils prennent en charge les réalisations en dehors de ce que peut faire le projet. Cette orientation se précise avec les programmes d'alphabétisation, de crédit confiés à des prestataires spécialisés et qui vont incessamment démarrer.

Cette évolution du projet va dans le sens de l'élaboration d'un modèle d'intervention pour une Communauté Rurale. Cette élaboration, sans remettre en cause les termes de référence, suppose des réorientations constantes du projet au niveau de l'U.G.P. mais des réorientation dont les justifications ne semblent pas être bien comprises des populations ou qu'elles ne veulent pas comprendre.

Sur la base de ces considérations, il y a lieu de se poser les questions ci-après :

- Quelle perception les responsables du projet ont-ils quant aux orientations ?
- Quelle perception la mission de l'USAID a-t-elle du projet ?
- Quelle perception les populations ont-elles du projet ?
- Qu'est-ce qui explique que le projet accepte de travailler en dehors de ces termes de références ?

Cet ensemble de questions suscitent quelques ambiguïté qu'il convient de lever au bénéfice à la fois des populations, du projet. Dans ce sens il convient d'explorer les axes de réflexions ci-après (section sur les Recommandations) :

- La clarification du point de vue de ses objectifs auprès des acteurs concernés, les bénéficiaires notamment.

- L'affirmation claire que le projet est en train de bâtir un modèle avec tous les acteurs concernés. Ce modèle va dans le sens d'un compromis entre les termes de références et les obligations de résultats aussi bien dans la GRN que les activités génératrices de revenus.
- L'éventualité de correctifs des termes de références, des accords avec le SECID est à envisager par la mission en vue de clarifier une situation. A défaut des journées de réflexion portant sur les orientations du projet en termes de compromis devront être organisées avec tous les acteurs concernés.
- Dans le même ordre d'idées, la recherche de modèle ne peut se faire qu'avec un nombre limite de CR. Il y a lieu dorénavant et déjà de réfléchir sur le nombre optimale de CR pour l'élaboration d'un modèle.

6.0 L'Evolution de l'Encadrement et les Leçons qu'on Peut en Tirer

6.1 Etude comparative

En introduction à cette évolution il y a lieu de faire une étude comparative du Proges, du PCGRN afin de mettre en évidence leurs limites dans ce domaine et les solutions qu'ils tentent pour résoudre les problèmes rencontrés.

- Il s'agit de projets très sectoriels, le Projet de Gestion des Eaux du Sud est plutôt orienté vers la constructions d'ouvrages de retenues anti-sel ; le PCGRN vers la gestion des Ressources Naturelles ; cela découle paraît-il d'une option de l'USAID de retenir les projets sectoriels à la place des projets intégrés.
- L'enveloppe financier consacré aux réalisations est très faible surtout dans le cas du PCGRN. Dans le cas du Proges, le recours à la main d'œuvre locale en termes de participation est importante ; cela a été accepté en raison de l'intérêt que les populations accordent à la lutte anti-sel pour sauver leurs rizières. Dans le cas du PCGRN, l'intérêt porté aux pratiques développées n'est pas évident ou dans tous les cas, est moindre.
- Il s'est avéré que l'intervention centrale des projets, retenus anti-sel dans le cas du Proges, GRN dans le PCGRN, ne peut résoudre les problèmes posés sans d'autres activités d'accompagnement. Cela s'est surtout vérifié avec le Proges ; des actions de démonstrations ont été entreprises mais à une échelle très petite, l'effet tâche d'huile est limité pour des raisons différentes d'un projet à l'autre. Pour les deux cas, la faiblesse de la repiquabilité s'explique par le manque d'expertise des vulgarisateurs à jouer ce rôle ; il s'agit des ONG dans le cas du Proges, des CERP dans le cas du PCGRN. Par ailleurs l'environnement ne facilite pas la diffusion des thèmes : analphabétisme, absence de crédit,...
- Dans le cas du PCGRN, cette situation est aggravée par la non pertinence des pratiques développées complètement décalées par rapport aux attentes des populations. Ces remarques quoique brèves pose toute la problématique

de l'orientation des Projets à l'USAID ; deux leçons importantes se dégagent :

- % Plus, le projet intègre les préoccupations des populations, plus l'intérêt est suscité, plus il y a des chances de réussites. Cette leçon conduit au concept de « porte d'entrée » déjà développé.
- % Pour la réussite des projets, l'environnement gagnerait à être amélioré notamment au plan de la prise en charge de la vulgarisation, des autres mesures d'accompagnement indispensables à une bonne vulgarisation. La présente note essaie de tracer quelques axes pouvant modestement éclaircir ces questions.

6.2 Un survol des expériences d'encadrement

Un rapide survol permet de voir que différentes approches ont été tentées avec plus ou moins de succès afin de régler les problèmes ci-dessus :

Les coopératives étatiques ont joué un rôle important dans la collecte de la production avec l'aide de structures étatiques centralisées (ONCAD) de banques spécialisées dans le crédit rural (B.N.D.S.). Dans ce contexte la vulgarisation des paquets technologies (Semis, traction animale, utilisation de l'engrais chimiques, labours, ...) était assurée par une société étatique (Sodéva, Sodéfitex, ...). Cette approche pris fin avec le désengagement de l'état ; elle a été relayée par le PNVA, un projet de la Banque Mondiale, celui-ci, avec ses agents de terrains s'appuyait beaucoup sur la formation des paysans, les visites organisées ; il ne fit pas long feu. Actuellement c'est l'approche Appui-Conseil qui est en préparation l'ANCAR (Agence Nationale de Conseil Agricole rural). Cette approche développera la stratégie du « faire-faire » chère à la Banque Mondiale. Les Ruraux ou leurs organisations pour la formation, l'appui conseil. Cette approche quoique intéressante ne peut être pérenne en raison des coûts de prestations qui à l'avenir ne pourront être supportés par les ruraux.

Des expériences intéressantes ont été lieu dans le passé, celles de BUD - Sénégal, dans la commercialisation des produits maraîchers, dans l'effet tâche d'huile au plan de la diffusion des technologies, celle des Libanais, de la famille « Gafari » de Rufisque dans la Production contractuelle, collecte, l'exportation de haricots verts, de melons. Plus récemment la privatisation de la fonction des vétérinaires donne des

idées sur le financement des prestataires de services, leurs relations avec la clientèle, les forces et les faiblesses de cette opération.

Dans le « Delta » la SOCAS a des contrats tacites de cultures avec les productions de tomates ; de nombreuses ONG ont développé dans leurs zones d'intervention des relations contractuelles avec les populations. Dans le cadre d'une approche participative, elles réalisent un certain nombre d'actions sur le terrain avec la facilitation d'un agent relais recruté par elle ou proposé par les populations. De nombreux projets adoptent à quelques nuances près la même démarche tout en étant plus sectoriels.

Le Projets Modernisation et d'Intensification de l'Agriculture, actuellement travaille en vue d'insérer des agronomes diplômés de l'enseignement supérieur dans la production maraîchère destinée à l'exportation. En faite il s'agit d'une opération qui portera sur le financement, le suivi d'un projet. Il y a là autant d'approches qui en un moment de leur existence ont essayé de résoudre un ou plusieurs aspects liés à la promotions rurale à savoir :

la vulgarisation

l'approvisionnement en matériel, en intrant

le crédit

la commercialisation des produits

l'amélioration du niveau d'expertise technique, du niveau en gestion des producteurs.

6.3 Leçons à Tirer

De ces approches, i y a lieu de tirer un certain nombre de leçons pouvant éclaircir les

stratégies qui vont dans le sens de la prise en charge des aspects ci-dessus ; plusieurs voies

se dessinent. :

- La voie de la porte d'entrée pertinente à l'image de ce que fait l'ONG Winrock avec les semences sélectionnées et de ce qui s'est fait dans le cadre de la fixation des durées dans la région des Niayes.
- La voie du privé, qui joue le rôle de moteur dans le développement de la production et des services à l'image de BUD Sénégal, du programme de privatisation de la fonction de vétérinaire.

Les deux voies peuvent être explorés selon les objectifs que l'on se fixe. La première sera explorée dans le cadre d'une vulgarisation de techniques de GRN dans les zones de grandes cultures. Des semences (ou l'équivalent en termes d'intérêt) seront garanties aux producteurs dans le cadre d'un contrat. le bénéficiaire s'engagerait à développer un certain nombre de pratiques de GRN adaptées à sa zone.

La deuxième peut être explorée partout dans le cadre de la prise en charge de la vulgarisation, de l'approvisionnement en intrant, de l'écoulement de la production ; un privé que l'on encouragerait par des mesures incitatives (crédit, mesures fiscales, ..) servirait de locomotive aux petits producteurs dans les domaines qui leur sont communs. Son exploitation servirait de champs de démonstrations par ailleurs sous la forme d'une centrale d'achats en intrants, d'une Centrale d'écoulement des produits, filiale de son exploitation, il aidera les petits exploitants dans ces domaines à travers son expertise, son niveau de relations. Par exemple il pourrait fournir des intrants aux petits exploitants, il pourrait les aider à écouler leurs productions. Son matériel pourrait servir pour les gros travaux tels que les labours ; tout cela, selon les modalités à mettre au point d'un commun accord.

Task Order No. 825
Contract NO. PCE-1-00-96-00002-00

Annex I.

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Prepared For
USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
(EPIQ)

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Task Order No. 825
Contract NO. PCE-1-00-96-00002-00

Annex J.

Scope of Work

**for a Life-of-Strategic Objective Impact Assessment for the
USAID/Senegal AG/NR Strategic Objective No. 2**

USAID/Senegal

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
(EPIQ)

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I. Purposes:

In close consultation with USAID/Senegal SOT2, this life-of-SO2 impact assessment contract team will:

A) Conduct an impact assessment of AG/NR investments from FY1992-1998 to describe, assess, and analyze the results and impacts under the current Country Program Strategic Plan (CPSP);

B) Analyze the FY92, FY94 and FY96 Knowledge, Attitudes and Practices (KAP) data sets and the Activity-specific data sets to identify plausible causes, reasons, purposes, and logic for the use and non-use of improved AG/NR practices/technologies in *Communauté Rurale (CR)*, villages, and households, considering eco-geographic zones, distinguishing between the SO2-funded Activity sites versus those sites that are not SO2-funded;

C) Collaborate with USAID/Senegal and the selected local contractor for the FY98 Knowledge, Attitudes and Practices (KAP) Survey, to be done at national as well as Activity-specific levels;

II. Background/overview:

USAID/Senegal is in the final year of implementing the AG/NRM Strategic Objective No 2 (SO2) under the FY 1992-FY1998 CPSP:

"Increased crop productivity through improved natural resources management (NRM) in zones of reliable rainfall".

Under the current FY1992 - FY1998 Country Program Strategic Plan (CPSP) there were originally two distinct SOs, one related to forestry and another specific to agriculture. They were:

- SO#2: "Increased crop productivity in zones of reliable rainfall"; and

- SO#3: "Increased value of tree production", into the current combined agricultural and natural resources (AG/NR) SO#2 stated above.

In March 1995, USAID/Senegal consolidated these original two strategic objectives for the following three reasons. First, there was a perceived need to focus implementation efforts on a smaller, more coherent set of objectives, in an era of declining resources. Second, the Senegal Reforestation Project, the only activity which directly and exclusively addressed SO#3, was going to end 3/31/95. Third, the Knowledge, Attitudes and Practices (KAP) surveys indicated that the rural populations ranked reforestation less of a priority than many other interventions. With the combined SO, USAID/Senegal has maintained the integrity of the two former SO's while adding the NRM concept. Indicators were combined and somewhat modified.

The FY1998-FY2001 Results Review and Resource Request (R4) Report will be the final R4 Report under this CPSP. It will be submitted to Washington in 3/99. More complete information and analysis are needed on the AG/NR investments to date for the final SO2 R4 report, as well as to inform future AG/NR investments under the new CSP.

In preparing the final FY1998-FY2001 R4 Report, USAID/Senegal must consider the overall impact of AG/NR investments under SO2, which have included the following activities:⁶⁴

SRP:	Senegal Reforestation Project
KAED:	Kaolack Agricultural Enterprise Development
NRBAR:	Natural Resource-Based Agricultural Research
CBNRM:	Community Based Natural Resources Management (including <i>CONSERE</i> , Peace Corps AG/NR activity MOU and USGS EROS PASA environmental monitoring activities with <i>CSE</i>) PVO/NGO Support
SZWM:	Southern Zone Water Management
OFPEP/WINROCK:	On-Farm Productivity Enhancement Program
RODALE	and other NGOs' NRM activities

⁶⁴ Activities which have time frames that preceded the FY92-98 CPSP, which will be assessed under this SOW include the SRP (8/86 to 3/95) and SZWM (8/88 to 3/98).

These activities use different approaches, interventions, processes and/or technologies toward achievement of SO2. Some of these approaches are specific to one activity, others are common across several activities. On whole, all the approaches were intended to test multiple hypotheses to achieve the AG/NR SO2, which evolved during the life of the CPSP.

Significant results have been produced, some of them unexpected. At this point, the magnitude and significance of all of the results are not fully documented. A study entitled the *Natural Resources Management "Limited Scope" Impact Assessment Report* (EPIQ-IRG, May 1998) was conducted in January-February 1998, focusing largely on the FY97 results under Key Intermediate Results (KIR) B: "Improved NRM techniques mastered and used by farmers". The assessment report contributed to a more complete understanding of the results attained, data system problems and the potential synergies among the new SOs under the new Country Strategic Plan (CSP). However, further work is needed to more thoroughly assess and document the impacts over the life of SO2 for the final FY1998-FY2001 R4 and to prepare for implementation of the AG/NR investments under the new CSP.

USAID/Senegal has been building a data base, which includes agricultural and natural resources (AG/NR) data, for results reporting. Under the framework of the current CPSP, a set of indicators was defined, and subsequently refined to monitor impact in the AG/NR sector. In order to assess people level impact, USAID/Senegal has attempted to develop a sector-level impact monitoring system for collecting data on the indicators regarding crop and natural resources management practices. Farm-level information and data have been and continue to be gathered by the SO2 funded activities. The monitoring system continues to pose problems which must be addressed in order to build a better monitoring system for the new CSP.

AG/NRM-based Knowledge, Attitudes and Practices (KAP) surveys have been conducted in even years (1992, 1994, and 1996) which provide contextual information on use of AG/NRM practices in Senegal. In 1992, the survey covered the regions of Kaolack, Fatick, Kolda, Ziguinchor, and Tambacounda and was extended in 1994 and 1996 to all 10 regions of Senegal. These surveys collected data and information from male heads of households on their knowledge of and attitudes towards agricultural practices and NRM technologies, and the use and non-use of these practices and technologies. In FY96 an attempt was made to gather similar data on female leaders within the sample households, as well.

Data from the KAP surveys and SO2-funded activities were to be organized in Paradox program files and included in the AG/NR data base for analysis and results reporting, as a critical element of the monitoring and evaluation plan. There continue to be compatibility problems with USAID/Senegal and partner-generated data, as well. Despite numerous efforts to harmonize the variable definitions, data collection methodologies, formats and presentation approaches of the numerous USAID/Senegal partners, problems persist. Additional efforts to improve data compatibility occurred during the later years of the current CPSP in order to conform with the re-engineering results oriented approach. Despite best efforts to date, the data collected at the SO2 Activity specific sites are still not consistent and compatible with the KAP data. Numerous other issues and incompatibilities, including variance in base line existence and reliability, proved very challenging to overcome.

The Natural Resources Management "Limited Scope" Impact Assessment Report (EPIQ-IRG, May 98) begins to describe results and impacts achieved under SO2. It also defines more clearly the parameters of the data system problems and incompatibilities among partners data, which must be corrected in order to better report final results under the current CPSP, as well as to more effectively launch the new CSP investments in the AG/NR sector. The *Senegal Agricultural Sector Retrospective Study* (TRD, September 1996) provides an analysis of past investments and status of this sector. In addition, the Final Project Report: Code 93-1.1 entitled *Management of Rural Knowledge Systems for Natural Resource Management in Senegalese Rural Communities* (by Project Coordinator, Sheldon Gellar, June 1998) contains important conclusions and recommendations to consider for future investments in natural resources and decentralization.

Under the **new CSP**, USAID/Senegal proposes to continue selected AG/NR activities as integral components of both the Private Sector (new SO1) and Decentralization (new SO2) Strategic Objectives. The logic behind this approach is that there is a strong synergy among AG/NR results and the results of these two SOs. The AG/NR interventions are dominated by a participatory approach and are done largely in conjunction with income generating interventions that are agricultural and natural resource-based, such as tree/shrub nurseries, small scale grain mills, cattle fattening, etc. Thus, the NRM participatory approach is directly linked to both better governance through empowerment at the local level and more income generating opportunities through NR-based enterprises. Moreover, the reasoning is that because of these synergies, impacts in all three sectors will be greater by integrating AG/NR than by having a separate AG/NR SO.

Technical direction for the contract team will be provided by the USAID/Senegal COTR. The USAID/Senegal COTR will work with G/ENV to obtain technical assistance as appropriate.

III. Detailed Statement of Work

A) Conduct an impact assessment of AG/NRM investments from FY1992-1998 to describe, assess, and analyze the results and impacts under the current Country Program Strategic Plan (CPSP).

The contractor will conduct a comprehensive impact assessment of impact of SO#2 Activities funded under the current CPSP over the past six (6) years, from FY1992 through FY1998. This assessment will include an analysis of the impact of AG/NR investments under the SO#2 results framework, an analysis of the economic and financial return on Activity investments, cost/benefit analyses of AG/NR practices and technologies, and a discussion of the sustainability and replicability of the Activities in the context of Senegal's AG/NR sector needs. The assessment report is to include both NR-based agricultural production activities and forestry activities.

The contract team will analyze the assumptions for undertaking these activities, the conformity of Activities with USAID/Senegal and GOS policies, as stated in documents such as Country Program Strategic Plan (CPSP), Grant Agreements and the Strategic Objective Agreement (SOAG), and relevant Africa Bureau guidance as well as USAID/W and GOS policy documents. It will provide a brief overview of other donor activities in the AG/NR sector during this period and which contributed to SO2.

The team will assess methodologies, determine best practices and lessons learned and make recommendations as to which approaches, activities, methodologies should be priority for continuation under the new CSP.

The performance results and impact will be assessed and reported in both quantitative and qualitative terms. Existing data from the previous KAP surveys and SO2-funded Activities, complemented by new FY98 KAP data collected during the course of this contract, in collaboration with the locally selected contractor, will be analyzed and the significance of the trends suggested by the data identified. The task will include assessing the extent to which each of the Activities achieved its purpose

and the extent to which each of the Activities contributed to the achievement of SO2 at:

- a) an individual Activity level;
- b) a technological level (e.g., agricultural research interventions, seed improvement, erosion control, organic additives, water management);
- c) strategic level (e.g., crop productivity);
- d) regional and national levels (e.g., increased crop production); and
- e) the policy level (e.g., forestry code, implementing regulations of the decentralization laws).

In conducting the assessment, the contract team will emphasize **CBNRM** and provide in-depth recommendations (similar to those which would previously have been found in a typical "mid-term" evaluation) considering the new CSP "demand driven" approach. This will encompass not only the activities performed under the SECID Cooperative Agreement with the GOS/MOEPN, including CONSERE, but also the USGS/EROS PASA activities with the *Centre de Suivi Ecologique (CSE)*, and the US Peace Corps MOU activities. Given that many activities currently conducted under CBNRM will be continued under the new CSP, recommendations must address how CBNRM financed activities might be improved and altered to continue to maximize results attainment under the new CSP PS SO1 and DG SO2. Although it is too early to assess the economic and financial return on this investment, the sustainability and replicability should be carefully studied.

KAED will be thoroughly assessed, as described above. The assessment will include visits to a representative number of sites and review of the KAED data bases where particular attention will be given to time-series data on adoption, training, etc. Key staff will be interviewed to get their inputs on unexpected outcomes and lessons. Approaches use by KAED will be reviewed and recommendations made as to how selected approaches might be improved and altered to conform to the new CSP PS SO1 and DG SO2. A financial and economic assessment of the returns on this investment should be conducted. Sustainability and replicability should be carefully studied. Recent evaluations by AFRICARE should be reviewed in conducting this assessment.

SZWM started in 8/88 and was terminated in 3/98 due to increasing insecurity in the area. Since travel to the area is prohibited, the assessment of this Activity must rely on document review, phone and personal interviews, to the extent feasible. Sustainability and replicability should be carefully studied. A financial and economic

assessment of the returns on this investment should be conducted, to the extent possible given travel ban.

The team will not conduct a detailed analysis of **NRBAR**, which was assessed in depth in June-July 1998 under a separate contract, in the context of 3 generations of projects funded through *ISRA (Institut Sénégalais de Recherche Agricole)* dating from 1981 to present. Highlights from that report will be considered by the contract team. Further information and clarification will be sought, as required, particularly regarding the applied research grants program for consideration for the new M&E plan.

The **PVO/NGO Support** Activity will continue through 6/99. Part of this Activity assessment will involve reviewing recent evaluation and audit documentation and make recommendations with regard to NGO community involvement under the new CSP.

SRP started in 8/86 and was terminated in 3/95. Since it is quite likely that both results and lessons are still being produced, the team will visit a sample of sites to assess these products. The SRP assessment will also rely on documentation review and interviews of select key partners, as available.

Forest Policy Changes: On-the-ground results produced by the new Forestry Code (modified in 1993 and 1996) will be assessed as an integral part of the above and, possibly, as a separate task. Working with personnel from the GOS and other partners, assessment team members will use site visits to determine whether people know about the code and whether it has affected how they manage their forest resources. It may be that the team will identify sites that are additional to those above where changes in the Forestry Code have produced results in the way that forest resources are managed.

The assessment of the BHR grant to **WINROCK to implement the OFPEP Activity** and another BHR grant to **RODALE** will be assessed with regard to their contributions to SO2. Particular attention should be paid to the BHR grant mechanism and its capacity to contribute to specific indicators and results under the SO2 RF. Recommendations on how to improve the process to ensure that these grants contribute to the same indicators and targets as the other implementing partners under the new CSP is critical. The recent evaluation reports of these activities will provide a strong basis for the team to assess the contribution of these Activities to SO2 results.

B) Analyze the FY92, FY94 and FY96 Knowledge, Attitudes and Practices (KAP) data sets and the Activity-specific data sets.

USAID/Senegal has carried out Knowledge, Attitudes and Practices (KAP) surveys in 1992, 1994 and 1996, respectively, utilizing formal sampling survey methods with a formal questionnaire schedule. In 1992, the survey covered the regions of Kaolack, Fatick, Kolda, Ziguinchor and Tambacounda. In 1994 and 1996, the survey was extended to all the 10 regions of Senegal. These surveys collected data and information from male and female head of households on their knowledge and attitudes towards agricultural (AG) practices and natural resource (NR) technologies, and the use and non-use of these practices and technologies. However, no in-depth analysis of the survey data has been carried out. Therefore, there is an information gap which must be filled if USAID/Senegal and the Government of Senegal (GOS) are to draw lessons for new AG/NR interventions.

The study will provide a thorough and comprehensive analysis of the KAP survey data to determine the cause(s), reason(s), purpose(s) and logic(s) for the use and non-use of improved AG practices/NR technologies in different eco-geographic zones, by the Rural Community (CR), village and household.

In conjunction with key implementing partners and the *SENAGROSOL-Consult* technical team responsible for the FY92, FY94 and FY96 KAP surveys, the contract team should conduct a thorough analysis of the data to date to determine AG/NR practice and technology use trends, as described above. Analysis will be done of the KAP data with the Activity-level data to identify plausible causes, reasons, purposes, and logic for the use and non-use of improved AG/NRM practices/technologies in *Communauté Rurale (CR)*, villages, and households, considering eco-geographic zones, distinguishing between the SO2-funded Activity sites versus those sites that are not SO2-funded.

The team will assess the number and type of improved AG/NR practices and technologies which have been adopted by rural households inside versus outside the SO2 intervention zone and assess the constraints and behavioral changes in relation to these developments. The team will identify the geo-physical, cultural and religious and any other determinants related to adoption of specific and individual AG practices and NR technologies in different agro-geographic zones, CRs, villages, and households.

The contractor team will identify patterns of individual (or classes of) NR technologies by agro-geographic zones, CRs, villages, and households relating bio-physical, institutional, cultural and other influences and attempt to rank and relate use of individual (or classes of) NR technologies to primary, secondary and tertiary determinants (e.g.: agro-geographic zones, institutional influences and cultural influences. It will highlight the "spread affect" of AG practices and NR technologies attributable to SO2 Activity interventions, identify lessons learned which will serve to document Activity successes and failures, and guide USAID and it's partners in implementation and monitoring of future AG/NR interventions under the new CSP. This analysis will be critical to the core task of determining overall SO2 impact for the final R4 report.

C) Collaborate with USAID/Senegal and the selected local contractor for the FY98 Knowledge, Attitudes and Practices (KAP) Survey, to be done at national as well as Activity-specific levels.

USAID/Senegal will contract with a local firm to conduct the FY98 KAP. The contract team will assist USAID/Senegal in the preparation of the local contractor's SOW. The contract team will collaborate with the local contractor and USAID/Senegal to refine the KAP survey questionnaire for the FY98 KAP survey. The local contractor's SOW will include benchmarks for approval by USAID/Senegal critical points in the conduct of the FY98 KAP survey in order to ensure quality control. The contract team will advise the selected, local KAP contractor through the entire process including the conduct of the FY98 KAP survey. This exercise is intended to strengthen the capacity of the local contractor, to ensure high quality products.

The FY98 KAP should be done in such a way as to capitalize on the standardized past KAP data. The 98 KAP survey should use a sampling strategy which maximizes compatibility with past KAPs, while anticipating the new CSP data needs. A stratified sampling strategy should be considered using sites both within and outside SO2-funded areas. Also, the size of the sample should be chosen based on statistical considerations (The sampling size varies from 1532 in the 92 KAP, 2850 in the 94 KAP, to 1048 in the FY96 KAP).

The team should collaborate closely with the USGS EROS experts engaged in mapping the former KAP data. In addition, the contractor should work closely with the DG SO2 Team in order to fully consider and possibly incorporate some

customer satisfaction and participation DG-related baseline data needs for the new CSP.

IV. Methodology

This multi-faceted SOW will require close coordination and careful scheduling of inter-linked tasks in order to achieve anticipated results in a timely manner. The assessment methodology will include but not be limited to:

- (a) read relevant documentation from USAID/Senegal and GOS offices (e.g., CPSP, Results Frameworks, Results Packages, SO Agreements, project papers, evaluations, etc.); examine the 1992, 1994 and 1996 KAP findings/results and electronic files; and analyze individual Kans separately

and provide a transversal analysis of the sub-sample of the households that were surveyed throughout the KAP92, KAP94 and KAP96;
- (b) conduct briefings with the USAID SO#2 Team and other relevant offices (Financial Management, CAT Team, Program, etc.);
- (c) interview appropriate GOS officials, participating private sector organizations, technical assistance teams, local populations and village groups, and other activity partners;
- (d) travel to field sites to assess the impact as well as monitoring of the implementation of the FY98 KAP, using an interview approach;
- (e) collaborate with key implementing partners to find commonalities and to analyze the general and specific activity-level KAP data, review existing data files, data sites, and information systems at USAID/Senegal and at key partners offices;
- (f) collaborate with the selected local contractor to design and implement the FY98 KAP;
- (g) work closely with Activity partners and selected USAID/Senegal M&E personnel regarding (e) and (f) above; and

(h) prepare the deliverables, as described below.

The different team members will spend varying, intermittent periods of time in Senegal over an approximate 5 months period to conduct their assigned tasks, to review, research, collect required data, analyze and write the required reports. It is expected that some of the six, core team member will arrive, leave and return again to Senegal during the course of the 5 month period. It is further anticipated that some additional skills, beyond the core, six person team may be required, and these specialists may be brought to Senegal for short periods for targeted tasks, and/or consulted via electronic media as "virtual "team members". It is expected that some tasks will be carried out sequentially, some tasks simultaneously, and that core and intermittent team members will come and go, as their skills are needed to accomplish the critical elements of the SOW.

The Team Leader and/or other team members may arrive in advance of the other team members, as deemed necessary, to organize necessary documentation, do advanced planning and scheduling of tasks. In order to complete the SOW, the Team Leader, and other key team member(s), as deemed necessary, may spend time in Senegal and/or in the US editing and incorporating comments into the draft and final reports.

Prior to starting the SOW, the contract team will discuss the methodology with USAID/Senegal officials, including any concerns, improvements or modifications being contemplated.

V. Timetable, Level of Effort And Team Composition

Timetable: The numerous tasks in this SOW will be fulfilled over the period of approximately 5 months, starting on or about October 19, 1998 through March 19, 1999.

Level of Effort/Team Composition: The core team will be comprised of 5 members working from a maximum of 4.25 person-months to a minimum of 2 person-months on the various tasks described herein. An additional 8 short-term person-months allow the contractor flexibility for additional specialists to fulfill required tasks under this SOW.

The contract team will be composed of:

- A. Team Leader/NRM Specialist/Land Use Planner: 17 person-weeks(pw)
(15 weeks in Senegal, 2 in US);
- B. Rural Sociologist: 14pw;
- C. AG/NR Economist: 13pw;
- D. Non-formal Education Specialist: 8pw;
- E. Statistician/Data Analyst: 13pw;
- F. Misc. Technical Specialists (i.e. survey questionnaire specialist, translator, editor, etc.): 8pw.

The responsibilities, technical expertise and other expected qualifications of the team members are described below.

A) Team Leader/NRM Specialist/Land Use Planner

Responsibilities: He/She will be principally responsible for all aspects of the SOW, assigning tasks to other team members and overall coordination of the team effort. He/she will be responsible for team building, management and coordination; schedule coordination and planning; all accomplishment of all assessment-related tasks and briefings. He/she will ensure that the assessment is completed on schedule. The incumbent should be a U.S. national.

Qualifications:

- At least a Masters degree in NRM, Land Use Planning or related field of study.
- Proven team leadership and team player experience.
- Development project evaluation experience.
- Minimum of 10 years development experience working in agronomy, soil science, NR or related field in Sub-Saharan Africa, extensive experience in Senegal is preferred.
- French language capabilities at FSI S3, R3 level.
- Excellent English speaking and writing skills.
- Computer software skills, including word processing, spread sheets, etc. are required, and knowledge of database software such as PARADOX and GIS software preferred.

B) Rural Sociologist

Responsibilities: Working with the other members of the assessment team, he/she will be responsible for the analysis of the socio-cultural underpinnings of the activity outcomes, both expected and not expected. He/she will be principally responsible for ensuring that the socio-cultural aspects of the Senegalese environment are accurately reflected from an indigenous "rural sociology" perspective, including such topics as degree of popular participation, roles of traditionally under represented groups, involvement of local organizations and collectives (i.e., rural councils, farmers, women) and people-level impact. In this regard the person will review all relevant documents and write and review appropriate sections of the report as instructed by the Team Leader. The incumbent should be a Senegal national.

Qualifications:

- A Masters degree, or equivalent, in rural sociology, geography or related fields.
- Minimum of 5 years of development experience is required in anthropology, sociology, geography, or a related field in Sub-Saharan Africa. Extensive experience in Senegal is preferred.
- French language capability at the FSI S3, R3 level.
- Excellent written and oral English skills at FSI S3, R3 level are preferred.
- Fluency in one or more local languages.
- Computer, word processing, database management, and GIS skills preferred.
- Proven team player experience.

C) AG/NR Economist

Responsibilities: Working in conjunction with other team members, he/she will be responsible for assessment of impact and the spread effect aspect of the assessment, working on the Kans, as assigned by Team Leader. Incumbent should be a US national.

Qualifications:

- At least a Masters degree in agricultural economics.
- A minimum of 7 years of overseas experience is required and at least 2 years in the Sahel is desired.
- USAID activity evaluation experience.
- Proven team player experience.
- French language capabilities at the FSI S3, R3 level.
- Excellent written and oral English skills.
- Typing and word processing skills.
- Proven team player experience.

D) Non-formal Education Specialist

Responsibilities: Working in conjunction with other team members, he/she will be responsible for assessing the impact of various non-formal training methodologies used by the different Activities and the spread effects of the training efforts. She/He

will highlight best practices and recommended methodologies which provide most promising results for non-formal training needs under the new CSP. The incumbent can be either a US or Senegalese national, locally hired.

Qualifications:

- At least a Masters degree in rural sociology, education, vocational education, or equivalent experience.
- A minimum of 7 years of experience in training rural population in the Sahel is required and at least 4 years of non-formal training experience in Senegal is preferred.
- Local language capabilities (Wolof and another local language) preferred.
- Excellent written and oral French and English skills preferred.
- Proven team player experience.

E) Statistician/Data Analyst

Responsibilities: Working in conjunction with other team members, he/she will be responsible for KAP and activity-specific data analysis, new KAP survey tasks, as assigned by Team Leader.

Qualifications:

- At least a Masters degree in statistics or computer science.
- A minimum of 7 years of experience in data analysis and field survey design.
- Developing country experience is required, at least 2 years in the Sahel, with Senegal-specific experience preferred, as well as experience with NRM activities, social science, social geography, and/or education.
- Experience in survey instrument/questionnaire design and GIS software desired.
- Proven team player experience.
- French language capabilities at FSI S3, R3 level.
- Excellent analytical skills.
- Excellent English writing skills.

F) Misc. Technical Specialists

Short-term specialized tasks may be required in areas not comprehensively covered by the core team members. These specialists could either work virtually or be physically present in Senegal during part of the contract time period, as required. Specialists envisioned here may include a survey questionnaire specialist, translators, editors, etc. This miscellaneous TA category can also be used to extend the time frames of the five (5) core team members, as required, to fulfill the terms of this SOW. Eight (08) person-weeks are allowed for these additional technical specialists.

VI. Deliverables

The contractor will be responsible for 7 deliverables:

- A) Work Plan and Timeline:** USAID/Senegal will work with the consultant team to develop a work plan. The work plan will discuss roles and responsibilities for both USAID/Senegal and consultant team staff, priorities, how the team will accomplish deliverables and the time frame and sequence in which the deliverables will be completed. The Contractor will provide USAID/Senegal with a work plan and time line schedule in English for implementing all components of the assessment for discussion and final approval by USAID by the end of week one (1) of the contract.

- B) FY92-94-96 KAP and Activity-Specific Data Analysis Report:** The Contractor will provide an analysis of the 3 KAP and activity-specific data. Ten (10) copies each of the report in English and French will be provided by week eight (8), or another timeframe mutually agreed upon by USAID/Senegal and the Contractor, as per Deliverable A. The contractor shall also provide two back up copies on diskettes of the working tables created from the data sets. The revised information for the FY98-FY01 R4 data tables will also be included (see deliverable VI.G. below).
- C) Draft Life-of-SO2 Impact Assessment Report:** The Contractor will provide USAID/Senegal with the draft assessment report in English and French (20 copies each) by the end of week fourteen (14) , or another timeframe mutually agreed upon by USAID/Senegal and the Contractor, as per Deliverable A. The draft document will include a table of contents, executive summary, the body of the report, conclusions and recommendations, lessons learned and appendices.
- D) Oversee and comment on the Draft FY 98 KAP Report:** The Contractor will assist in the FY98 KAP development process and provide written comments on the local contractor's draft FY98 KAP results and analysis report. The comments will be delivered in English and French (5 copies each), within 5 working days of the date the draft FY98 KAP results and analysis report is received by USAID/Senegal, or another timeframe mutually agreed upon by USAID/Senegal and the Contractor, as per Deliverable A.
- E) Critique of the final FY 98 KAP Report:** The Contractor will provide written critique of the final FY98 KAP Report, a description of the FY98 KAP process, and an institutional capacity assessment of the local firm. This final FY98 KAP results and analysis report will be in English and French (10 copies each), and on diskette (WP5.1/5.2), and cover I.C KAP planning and implementation phases. The critique will be delivered to USAID/Senegal no later than 5 work days after the final KAP Report is received from the local contractor, or another timeframe mutually agreed upon by USAID/Senegal and the Contractor, as per Deliverable A..
- F) Final Life-of-SO2 Impact Assessment Report:** The Contractor will provide USAID/Senegal with the final report (in English and in French (25 copies each) no later than 3 weeks after comments are received from USAID/Senegal and partners (via USAID/Senegal) on the draft report, or another timeframe mutually agreed upon by USAID/Senegal and the

Contractor, as per Deliverable A. The final report will be comprised of a table of contents, executive summary, the body of the report, conclusions and recommendations, lessons learned and appendices. The final report including annexes shall be submitted in hard copy and on diskettes in WordPerfect 5.1/5.2 in both French and English.

- G) FY1998-FY2001 R4 Report for SO2:** The team will provide a 6-8 page narrative summary of SO2 performance and impact, following the R4 guidance and format, accompanied by updated data tables. The results from KAP92, KAP94 and KAP96, KAP98 will be incorporated, as required, into the R4 data tables. This shall be submitted in hard copies in both French and English (5 copies each) and on diskettes in WordPerfect 5.1/5.2 by the end of week 15, or another timeframe mutually agreed upon by USAID/Senegal and the Contractor, as per Deliverable A.